



# CARAPLACE MANUAL

Turtle Health Research, James Cook University

College of Public Health, Medical, Veterinary Sciences 2021

# Husbandry Tasks

## I. Daily Routine

Daily hygiene is essential to the health of the volunteers and sea turtles. Follow these steps immediately upon starting your shift.

**Step 1:** Take off all jewellery (including watches) up to your elbow and leave phone behind in the lockers provided. No food or drinks are allowed in the wet areas. Put on a reusable hair net, remove your shoes, and put on a pair of Crocs that remain within the Caraplace. Please be aware there are security cameras in the facility that will be pointed out to you during your induction.

**Step 2:**

**TEAM LEADERS:** visually inspect turtles and equipment upon entry to the facility – do not touch the water! **LOCK-OUT PROTOCOL:** team leaders are to shut the electricity off to the systems and lock them with single key locks. The power must be turned off before commencing any work in the Caraplace (Figure 1).

**Volunteers:** Do not commence any work before team leaders have turned off and locked out the electricity. You must wait until all systems are locked-out before starting. Please also ensure before touching the water, handling turtles, and performing any tasks that the power has been switched off.



Figure 1. Before commencing any work with the water, turtles, or equipment, the electricity must be turned off and locked out. The electricity can be restored when all work is completed at the end of husbandry or project work.

**Step 3:** Wash and scrub your nails, hands, and arms all the way up to your elbows with disinfecting soap called Chlorhexidine (Figure 2). The Chlorhexidine is the pink liquid above the sinks.

**Step 4:** Check the white board for any important announcements, even if your team leader has verbally communicated any changes to you (Figure 3). Also, check the daily task sheet that your team leader will make available to all volunteers. This sheet is used to tick completed tasks and can be found in the “Daily Task Sheet” folder in the meeting room.



Figure 2. Upon entering the Caraplace, scrub and wash your hands, nails and arms with the Chlorhexidine soap provided. Scrub up to your elbows because your arms are likely to be submerged in the tanks. Scrub underneath your nails to reduce the spread of harmful bacteria. Please note, the watch may not be worn during husbandry.

**Step 5:** Set up a series of freshwater baths for equipment to be rinsed in (Figure 4). Typically, four rinse bins are placed on top of two other tubs or on a platform that isn't being used. All of these containers are found together, usually drying upside down on the walking platform. The sink is plugged with the stopper and filled with detergent to clean any equipment. Make sure to use the scrubbing brush if it is appropriate.

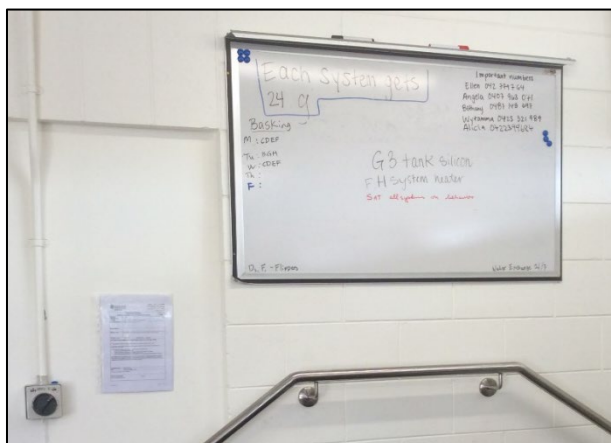


Figure 3. Make sure to check the white board for important announcements next to the main entrance on your way in.



Figure 4. Set up the rinse bins to get ready to wash equipment according to proper protocol (refer to *Rinsing Equipment*).

Now you are ready to begin the day's duties!

**Step 6:** Perform daily tasks as provided on the task sheet. Return turtles to their tanks.

**Step 7:**

**TEAM LEADERS:** Turn the electricity back on once the turtles have been returned and all husbandry is confirmed as completed.

**Step 8:**

Wash your hands and your lab shoes and you are ready to go. Let your team leader know you are leaving.

**TEAM LEADERS:** Ensure all equipment is functioning. Wash your hands and your lab shoes and you are ready to go.

## II. Daily Tasks

### Basking



Figure 5. In 2016 - 2018, hatchlings are placed in ice cream containers inside of the gate to get direct sunlight in the morning. This is good for the carapace and well-being. If turtles ever are placed outside, the green mesh must be put overtop the containers for added protection from predators.

All the sea turtles are placed in ice cream containers to bask in the sun by the metal gate or in the tanks in the Outer Shell. It's important to expose the hatchlings to sunlight to maintain a healthy carapace (Figure 5). Ice cream containers are found on the shelf next to the sink; place one turtle in one container. If the hatchlings are placed outside of the metal gate, place the protective green mesh over the containers. In the summer months, it is best that the turtles aren't placed in direct sunlight for a prolonged period because the containers can heat up very quickly. In the winter months, ensure the basking water is warm before removing the turtles from their holding tanks.

After the basking session is over, please rinse the turtles underneath a freshwater tap to wash off any food debris. Handle the turtles safely back to their appropriate holding tank (see *Identification and Handling*). Then, clean and rinse the containers according to the cleaning equipment protocol (page 9). Place the container upside-down on the trolley to dry.

### Feeding

The appropriate amount of food must be defrosted in the refrigerator the day before husbandry. It is important for everyone to realise that food is to never defrost on the food prep table! This limits the growth of unwanted bacteria. Gelatin feed cubes are found in the far-left freezer in the cold room, and cut the appropriate amount of food needed per system (Figure 6).

While hatchlings are under 500 g, food needs to be cut into pieces that are approximately the size of the distance between their eyes. The food will be put into ice cube trays labelled by system. Again, refer to the labelled trays by **SYSTEM**. The daily amount is adjusted every fortnight after the turtles are weighed. Turtles are fed a particular percentage (e.g 5%) of body weight Monday through Friday, unless otherwise changed.

To determine how much food a system gets Monday through Friday, refer to the Excel document for the automated formula. Be mindful that



Figure 6. Gelatin cubes are found in the chest freezer on the left.

feeding regimes may be different between species and between systems. Always keep up to date with the team leader. Here is the formula just for reference:

Find average of system averages:  $SA = (B+C+D+E+F+G+H) / 6$

Find desired percentage of weight:  $PW = SA/100 * 7$  [finding 7% of SA]

Find amount of food for seven days a week:  $WK = PW*7$  [days a week]

Find amount of food given Mon-Fri:  $FV = WK/5$  [fed five days a week]

Find amount of food to give a whole system:  $WS = FV*6$  [six turtles per system]

The hatchlings are fed in their basking container to reduce the amount of organic waste in the systems. The turtles may transition to feeding in their systems as they get larger or research is going on. Stay up to date with your team leader.

At the start of feeding, offer the turtle one cube of food at a time to confirm they are interested in eating; once they have eaten the first few pieces, you can offer the turtle a few pieces at a time (Figure 7). Feeding a few pieces at a time also limits disintegration of the food in the water; thus a loss of nutrients. Also keep food out of direct sunlight to ensure it does not melt.

Juvenile turtles are fed both cubed food and vegetables (Figure 8). Again the turtles are fed one piece at a time to begin with. All of the cube food is fed to the turtles first and the thawed vegetables after that. Be sure to remain out of view when feeding ALL turtles. Drop food pieces into the tank or basking container and stand out of view while the turtle is eating.



Figure 7. Turtles are fed one cube at a time to gauge their interest in food. After that, a few pieces may be given to the turtles.

Special attention or feeding techniques may be required if a turtle is having trouble eating or has lost interest in food. It's important to monitor the eating behaviour of the turtles. **Please let the team leader know of any odd feeding behaviour so adjustments can be made and make sure to write on the daily husbandry task sheet that the turtle wasn't eating well.** If there is food left in the container after approximately twenty minutes, try to quantify how much the turtle has not consumed. Although it is subjective, having these records will help the team manage any problems a turtle may have. Most times, there may only be debris left. This could be from the turtles squirting water through their nostrils while eating or from spitting out food it had just bitten. Attempt to determine a percentage of food the turtle left from the debris if you believe it is significant.

Return the ice cube trays to the cold room to be cleaned in the cold room sink.



Figure 8. Juvenile turtles are fed both cube food and vegetables in their holding tanks.

## Siphoning

Each system has its own siphon tube to remove solid waste and food scraps. Your goal is to remove as much solid organic waste as practical from the tanks and the sump for each system. To siphon, you will need the siphon tube and a spare bucket to collect all solid waste from the system. Refer to Figure 9 to help you understand the process of starting the siphon.

- Spiral (roll) the siphon tube with both hands and hold one end of the tube with your dominant hand (Figure 9.A).
- Place the tube underwater in the holding tank (or sump) and raise your dominant hand higher than the spiral bundle in your opposite hand. This will allow air inside the tube to rise and escape to the surface (Figure 9.B).
- Once all or most of the air has expelled from the tube, plug the higher end in your dominant hand with your thumb.
- Pull the entire tube out of the water, while still plugging the dominant end with your thumb, and release the rest of the tube into the bucket so the other end is lower than your dominant hand (Figure 9.C).
- Place the end plugged with your thumb under water in the holding tank you are cleaning. Then, it is ok to remove your thumb. This will create a vacuum and the water is siphoned out of the tank via the tube (Figure 9.D)
- Use your thumb to plug the tube whenever you want to stop the suction, e.g. moving from one tank to the other.

When you are siphoning, the opposite end of the siphon tube should be in the system's sump (Figure 10.A). If there are any solids in the holding tanks or sump, place the opposite end into the bucket (Figure 10.B). **NOTE: This may change – stay up to date with your team leader.** Use this bucket only for solids so that they can be discharged down the drain later. Any other small debris can return to the sump; ensure the opposite end is in the sump so we can recycle. However, it's important to note that this method may change depending on saltwater availability and water quality.

To clean the siphon tube:

- Use the same spiral method in the cleaning sink. Make sure soapy water gets inside the tube.
- Take the end in your dominant hand to the water spout to flush the inside with fresh water
- Rinse in the freshwater baths.
- Return the siphon hose back to the system – do not coil the hose! Let it hang so water can drip out.

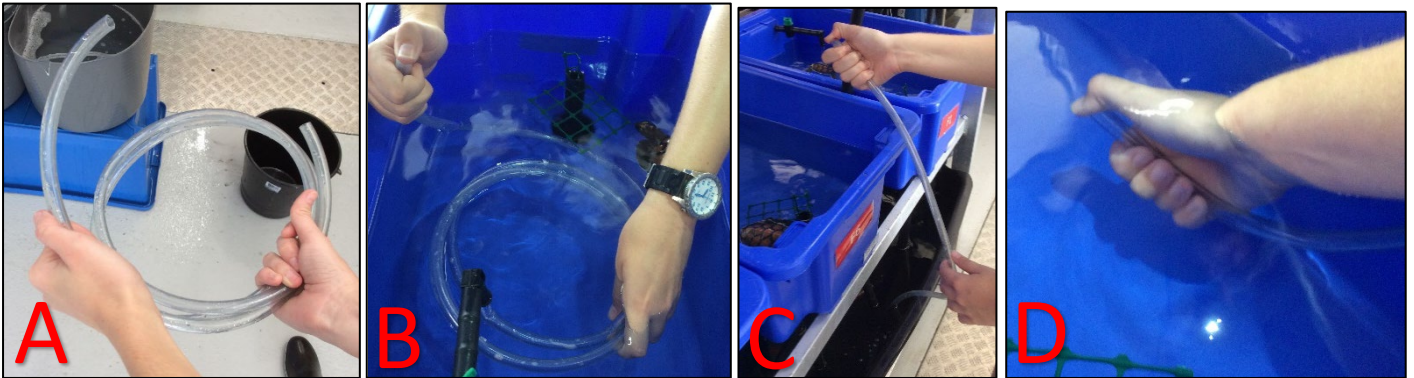


Figure 9. Follow this sequence to begin the vacuum in the siphon tube. A) Spiral the tube in your non-dominant hand and hold the other hand in your dominant hand. B) Put the spiral end underwater into the desired tank, followed by the end in your dominant hand - hold this end higher than the spiral underneath the water. C) Once most of the air is expelled, plug the end in your dominant hand with your thumb and drop the other end into the bucket. D) Release your thumb from the dominant end once it's underwater to begin siphoning.



Figure 10. A) Use the system bucket to collect the water you have siphoned out. B) On certain days the sumps are siphoned. Use the system bucket to collect debris.

## Cleaning skimmers

Skimmers are cleaned at the end of all husbandry duties because they are the dirtiest equipment we clean (Figure 11). To reduce the amount of organic matter getting on other equipment being cleaned in the sink, fill the system bucket with fresh water to get the majority of waste off of the equipment cleaning the skimmers.



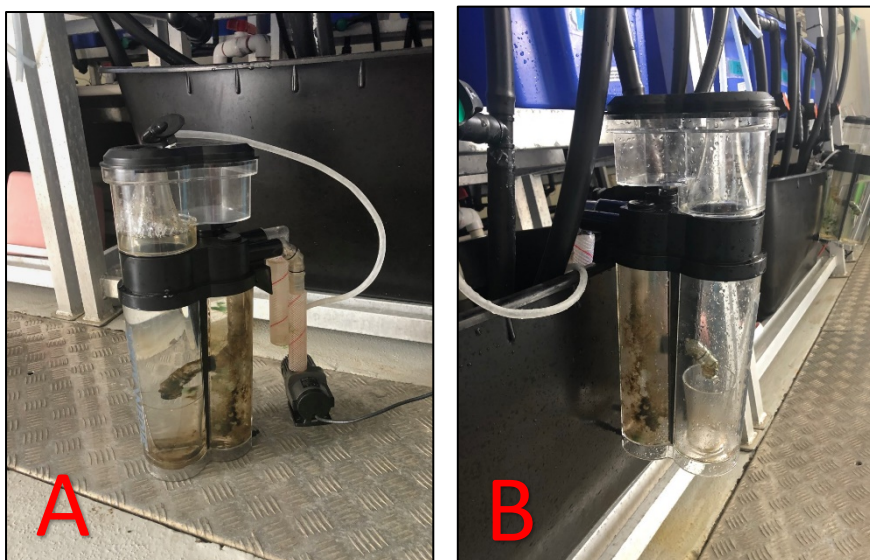


Figure 11. The brown matter is protein waste pulled from the saltwater in the system. Get rid of as much as you can however the back compartment of the skimmer is inaccessible and therefore hard to clean. A) Skimmer before cleaning B) Skimmer after full clean.

To clean the skimmers, you need the Chux, a toothbrush and the freshwater hose. There should be a Chux and toothbrush designated to each system.

The skimmer can be cleaned one of two ways:

- A full clean (done periodically):
  - **Ensure the electricity is still OFF.**
  - Remove the skimmer from the sump and place on the floor beside.
  - Be careful to keep the air hose dry and away from any water.
  - Disassemble the skimmer: Remove the pump, foam cup and outlet hose from the skimmer body

(Figure 12.A).

- Place the foam cup with lid and outlet hose in the system bucket (Figure 12.B). Rinse these off with the hose and wipe clean with the chux cloth to remove organic waste.
- To clean the body of the skimmer, blast water from the hose into the first chamber to dislodge organic material. Use a toothbrush wrapped in Chux to further clean this chamber. To clean the rear chamber and the inner pipes, blast water through the outlet hose and water inlet (Figure 13).
- Half-fill the skimmer body and shake vigorously on its side to dislodge organic buildup in the rear compartment. Dispose of this water and repeat until most organic waste becomes dislodged.
- Gently rinse down and wipe the pump system, making sure to keep the air hose away from water (Figure 14).
- Reassemble the system and place back on the sump. Make sure the pump is below the water level and the air hose is securely away from water.



Figure 12. Disassemble the skimmer body and place foam cup, lid and outlet pipe in the system bucket to be cleaned.



Figure 13. Use the hose and toothbrush with chux to clean hard to reach areas.



Figure 14. Gently rinse and wipe down pump system to remove organic waste buildup.

Alternatively a partial clean may be done. A partial clean should be completed a few times a week.

To complete a partial clean:

- Remove the foam cup from the skimmer body.
- Dispose of organic waste down the drain.
- Hose the organic matter off the foam cup and lid using the chux cloth to wipe clean. The chux cloth may be wrapped around the toothbrush to clean hard to reach areas.
- Once all organic matter is removed, rinse the foam cup in the soapy water in the sink in the carapace.
- Be sure to thoroughly rinse the foam cup with freshwater and reattach to the system.

Ensure all equipment is cleaned and put back with the system on completion of the task. All water waste is to be dumped down the drain

grate on the floor as needed.

## Cleaning Surfaces

It is important to wipe down all surfaces at the end of husbandry. Scrub the inside of the sink and the counter with disinfectant or detergent. Rinse the sink and counter with soapy water. Wipe down the table with disinfectant or 70-80% ethanol solution, which are located in the cold room. Wipe down door handles to the cold room, gate, and main entrance. Also, wipe down the legs of the tables as salt water causes them to rust. Ensure spaces are left clear and all equipment is stored or returned to appropriate locations.

## Cleaning Equipment

Any equipment used for husbandry duties must be cleaned. Scrub equipment with a scrub brush provided with the soapy water in the sink and rinse bins that were used with handwashing. Dip each piece in all four rinse bins. If one rinse bin is becoming too sudsy or dirty, please replace the water. This is the proper cleaning technique you should practice for most, if not all, equipment.

## Rinse Floors

At the end of all tasks, rinse the Caraplace floors with freshwater using the two hoses at either end of the room.\*\*

\*\*In the event of drought restrictions, rinsing the floors with freshwater is kept to a minimum. It is encouraged to distribute the freshwater from the four rinse bins across the room at the end of husbandry. For instance, have one volunteer pour the rinse water across the floor while another volunteer follows with a broom to push the water to the drain. Keep in mind the floors will be disinfected every two weeks. It is also advised to keep dirty water spillage to a minimum (i.e. skimmer waste water, and siphoned system water). Please discard dirty water directly down the drain grate. If floors get particularly dirty and more than the water from the rinse bins are needed, use the hoses to your best discretion.

## Wash Hands

At the end of your shift, please remember to wash your hands. Germs and bacteria may be transferred to you from various origins while working in the Caraplace. Always keep biosecurity in mind!

## III. Scheduled Tasks

### Weighing

The turtles are weighed once every fortnight to monitor their growth and ensure they are putting on weight as it's a good indication of welfare. In general, as long as the overall weight trend is increasing, it is acceptable for them to not gain, lose, or maintain weight over a short period of time.

To weigh hatchlings under one kilo, you will need the turtle weighing scale, an ice cream container and towels. To weigh the juveniles you will need a large bucket with handles, the luggage weighing scales and towels. Before handling the turtles, review the correct handling techniques in *Identification and Handling*.

Each system is handled separately while weighing and is recorded on the daily task sheet. It is also more effective to weigh if at least three volunteers are assigned tasks: One to scribe; one to dry and weigh; and one to measure the straight carapace length (SCL) and/or curved carapace length (CCL). Take the time to inspect and then transfer back to their tank. In general, it's better to have a standardized routine to ensure that all data is collected efficiently and correctly.

#### Recording hatchling weights:

**Step 1:** Collect all of the turtles from one system and place them in their respective ice cream containers (Figure 15.A). Do not fill the containers with water. Typically they are not as active when they are placed in an empty tub; the turtles will need to be dried before they are weighed, anyway.

**Step 2:** The scribe can place a dry, ice cream container on top of the scale for the turtle. The scribe can also be in charge of cleaning, disinfecting, and drying equipment between systems.

**Step 3:** The volunteer that is drying the turtles should handle them in order, 1-6 (Figure 15.B). Orally express and repeat which turtle is being handled. Repeating information multiple times is best practice.

**Step 4:** The drier should orally repeat which turtle is being handled; place the turtle in the towel to dry it off and calm it down. You can do this by carefully applying pressure to the turtle's head and carapace with the palm of your hand. DO NOT apply strong pressure. Place the turtle's head towards the open side of the towel, as to not smother the turtle. Once the turtle is calm, place the turtle in the ice cream container to weigh.

**Step 5:** Record the weight by communicating the turtle's weight to the scribe (Figure 16). Always repeat the number back to one another for verification.

**Step 6:** Safely handle the turtle and obtain the SCL and/or CCL. This will be discussed in the next session.

**Step 7:** Inspect the turtle's body for any abnormalities. Make sure to record anything suspicious and communicate any concerns to the Principle Investigator.

Repeat this process for every turtle in the system.

Once an entire system has been weighed, wash and dry the ice cream containers. If the towel is being reused, ensure the drying location is different for each system. The volunteer that is drying the turtles also has the responsibility of keeping track of what part of the towel has been used for a system. If not, place the used towel in the laundry bin and collect a new towel. Towels are stored in the cold room in a clear box in the shelf.



Figure 15. A) Collect the whole system in their respective ice cream containers. All the turtles from system "B" are in this photo. B) Gently place the turtle in the towel and gently dab the turtle dry. Bear in mind that a little bit of pressure will calm the turtle down if it is anxious, but do not smother it. Also remember the turtle needs to breathe.

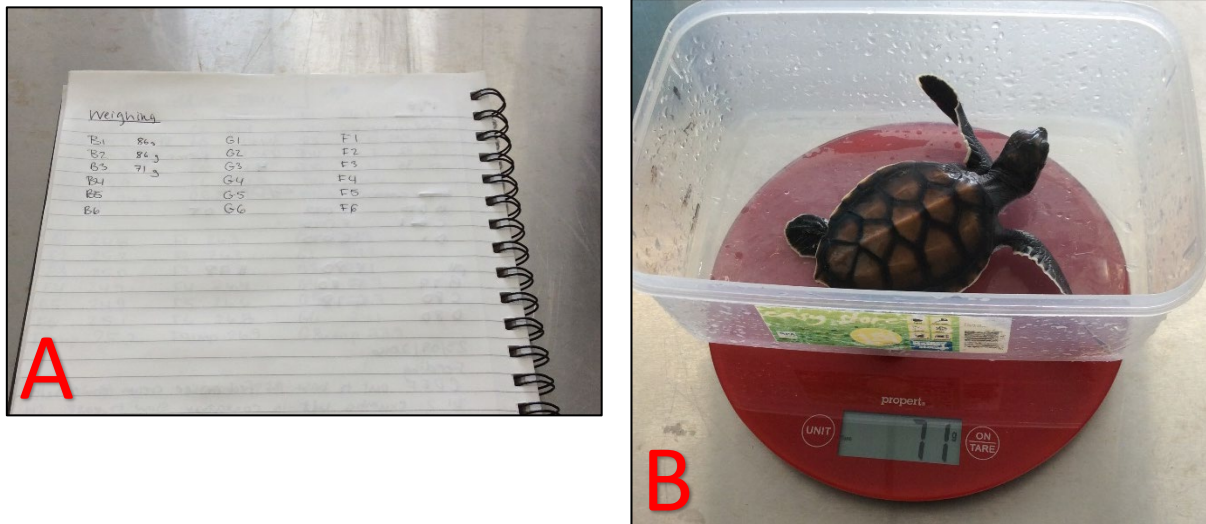


Figure 16. A) The scribe has the responsibility of recording the weights of the turtles. If the daily task sheet is not available, make a list that looks like this. B) When placing the turtle into the container, repeat out-loud which turtle is being weighed. Once the scale has balanced, say the weight out-loud to the scribe and repeat the turtle's identification. The scribe should also repeat the same information back to person weighing.

### Weighing the juvenile turtles:

**Step 1:** Tare the weigh scales with a large dry bucket attached. This must be done for every turtle that is weighed.

Step 2: Dry off the turtle to be weighed with a clean towel (see Figure 15.B).

Step 3: Place turtle in the bucket. Hold the scales still until the reading is steady, making sure the bucket is lifted off the ground (Figure 17.B).

Step 4: Record the weight and remove the turtle. Repeat the reading to ensure it is recorded accurately.

**Step 5:** Safely handle the turtle and obtain the SCL and/or CCL. This will be discussed in the next session.

**Step 6:** Inspect the turtle's body for any abnormalities. Make sure to record anything suspicious and communicate any concerns to the Principle Investigator.

Repeat this process for every turtle in the system. Make sure to use a clean bucket and towel between each system.



Figure 17. A) Empty weighing bucket and rope (if being used) must be tarred before the turtle is weighed. B) Hold the bucket still until a steady reading can be recorded. One person must be underneath the bucket to catch it if it falls. We practice this in the field too.

## Measure Straight and Curved Carapace Length

The SCL and CCL are also useful data that allow us to interpret their growth rate. This task is done immediately after a turtle is weighed because they are dry and are already being handled. Please practice safe handling techniques while performing this task. The digital calipers is kept in the cold room above the food prep table on the shelf for SCL measurements and the measuring tape is kept on the drying rack beside the sink in the Caraplace.

Three volunteers are needed to obtain the SCL and/or CCL – a scribe, a handler, and a measurer. During your training, confirm which measurement is being taken.

### How to measure SCL:

**Step 1:** Before picking up the turtle, ensure the calipers is “closed” and turn on the equipment by pressing the red button (Figure 18). It is a good idea to get used to the instrument before use because it is rigid. Use the knob to the right of the digital face to move the caliper back and forth along the ruler.

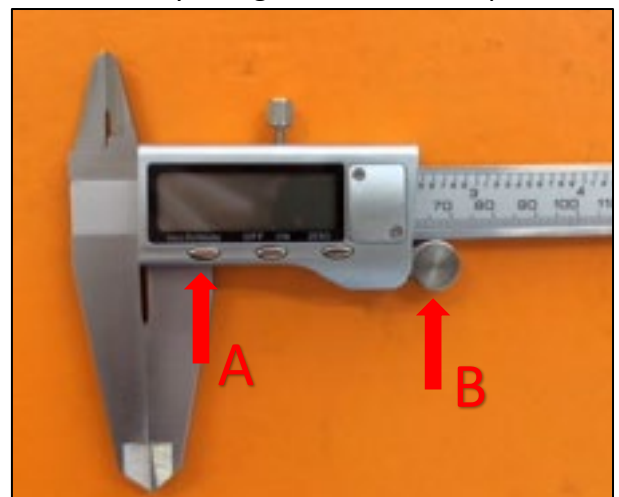


Figure 18. The digital caliper is useful tool in interpreting a turtle’s growth rate. The photo above displays the caliper “closed.” A. The on/off button. B. Knob to glide caliper open and closed.

**Step 2:** Close the calipers completely, then zero the calipers. **It is important to zero the calipers between every the turtle.**

**Step 3:** Carefully pick up the turtle from the scale bucket and safely stabilise the turtle.

**Step 4:** Slide the calipers open using the knob and place the appropriate measuring pointers around the top and bottom notch (known as the notch-to-notch measurement) of the turtle's carapace. The top notch is found directly at the mid-point of the carapace by the neck (the nuchal scute) and the second measurement is between the last two marginal scutes where it creates a "V" shape. The measuring points need to be firmly placed on the carapace, not *squeezing* the carapace (Figure 19). Be careful as the pointers are sharp and can scratch the turtle's soft skin.

**Step 5:** Read the measurement on the digital reader to the scribe. Also check the reading on the scale bar to ensure the electronic measurement is accurate. Repeat the reading and ensure the scribe has it recorded correctly for the correct turtle (Figure 20).

**Step 6:** Zero the calipers before measuring the next turtle. Repeat until the system is completed.

**Step 7:** Spray the disinfectant onto a paper towel to wipe down. **DO NOT DIRECTLY SPRAY THE CALIPERS.** Clean the measuring face with a paper towel and disinfectant between systems and at the end of the task.



Figure 19. The pointers are placed on the carapace "notch-to-notch." Place one pointer at the midpoint of the nuchal scute at the base of the neck and the other pointer between the last two scutes where it makes a "Y" shape. Do not squeeze the carapace.



Figure 20. Make sure to repeat the measurement back and forth with the scribe. This is good practice.

### To measure CCL:

**Step 1:** Carefully pick up the turtle from the scale bucket and calm the turtle down on a flat surface.

**Step 2:** Place the measuring tape along the curve of the carapace. The curve is measured from the point at which the skin meets the carapace at the neck of the turtle to the notch between the last two marginal scutes where it creates a "V" shape (Figure 21). This is called notch-to-notch as mentioned above.

**Step 3:** Repeat the measure again for that turtle to ensure you get the same measurement twice and record that measurement. In the field, we will do this measurement several times and confirm the measurement between several people. This can be time consuming, but it's important to know how to accurately measure the CCL.

**Step 4:** Repeat for all turtles within the system. Disinfect the tape and repeat for the remaining systems.

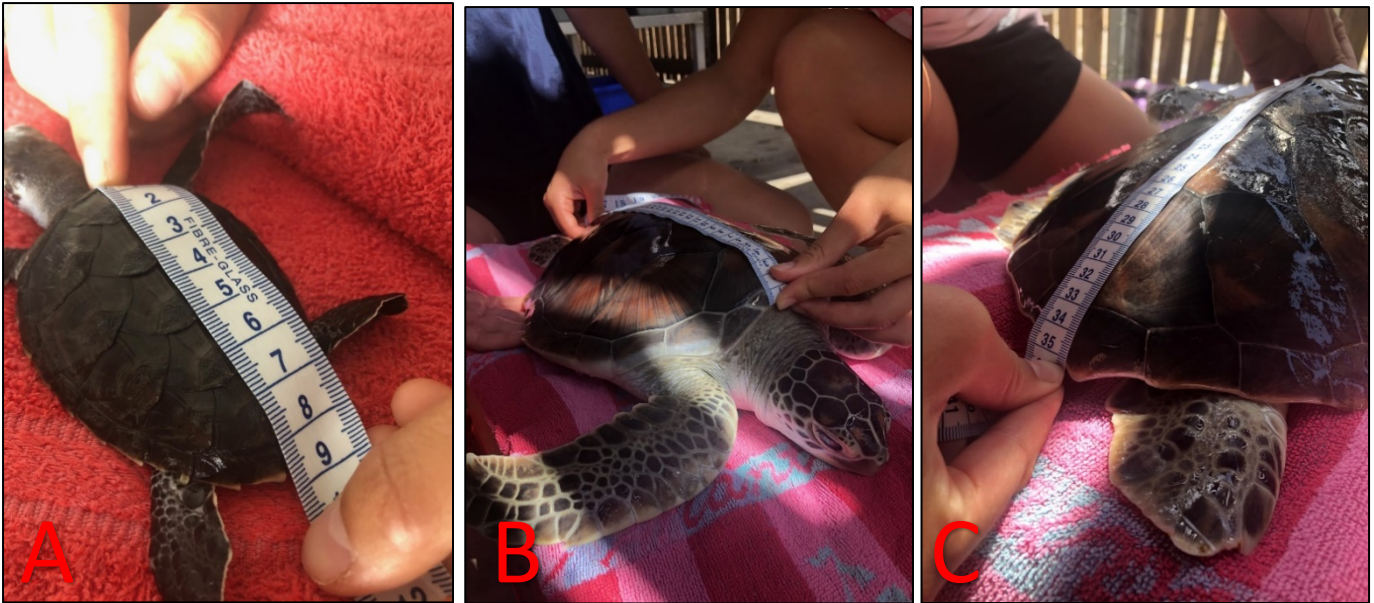


Figure 21: A) Measure the curved carapace length down the center of the carapace. B) Measure from the edge of the carapace where it meets the skin at the neck of the turtle. C) Measure to the notch between the last two marginal scutes where it creates a “V” shape.

## Inspect Turtles

Thorough visual inspections are typically done every fortnight while weighing and measuring the turtles; inspections can also be done at any time. It is important to keep track of the growth of the turtles, their appearance, and any abnormalities. All of these factors, along with feeding habits, allow us to understand the condition of the turtle. Your team leader will communicate the necessity of doing a visual inspection on weigh day.

Be sure to discuss and confirm anything you notice with team leaders. Here are some things to look out for:

- Scars, cuts, wounds anywhere on body (Figure 22)
- Flaking, dryness or dark patches on the carapace
- Neck girth (skinny or bulky)(Figure 23, 25)
- Body type (compressed or thick)(Figure 24)
- Plastron (concave or convex and/or markings)(Figure 26)

Some observations may be natural and are signs of growth, but most things are recorded for long-term records. For example, the turtles may shed their scutes creating a flaky or bubble-like appearance at the borders. However, we want to keep an eye on this as there could be growth underneath the shedding areas.

Refer to the following pictures (Figures 22-26) for examples of things you may come across.





Figure 22. This turtle has a callous on the back of its neck, most likely due to constantly looking upwards out of the water. This appears to be healing, but should be monitored.



Figure 23. This turtle appears well - it has a thick neck and full shoulders. However, this turtle has black markings on the central scutes.

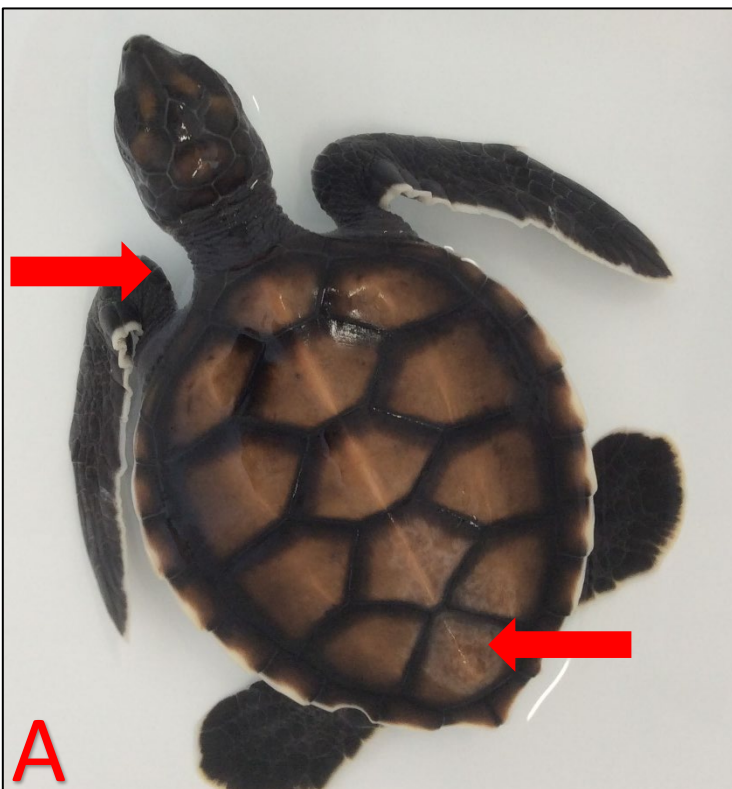


A

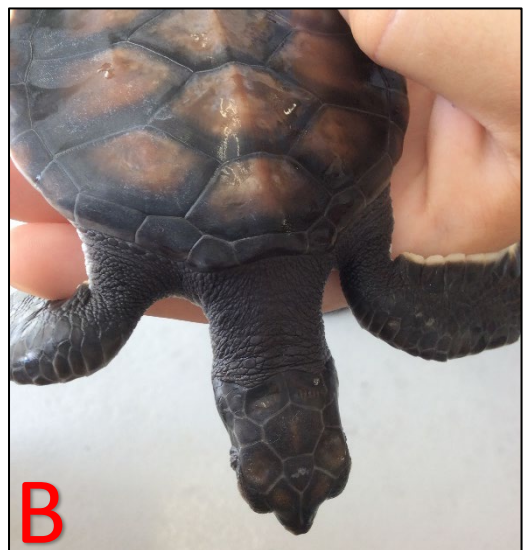


B

Figure 24. Hatchlings may grow at different rates. Some may grow lengthwise, while some may grow in thickness. A) This turtle is slimmer and has a sloped body shape. Refer to Figure 26A to view its concave plastron. B) This turtle is thick bodied and is filling out well.



A



B

Figure 25. A) This turtle's neck is thinner. Its head appears boxy as the neck tapers in. This turtle's carapace also has scutes that are exposed to air for long periods of time due to spending a lot of time at the surface, but it doesn't appear flaky. In this instance, it is worth investigating its feeding behaviour to ensure it is eating. B) This turtle's neck and shoulders are full.

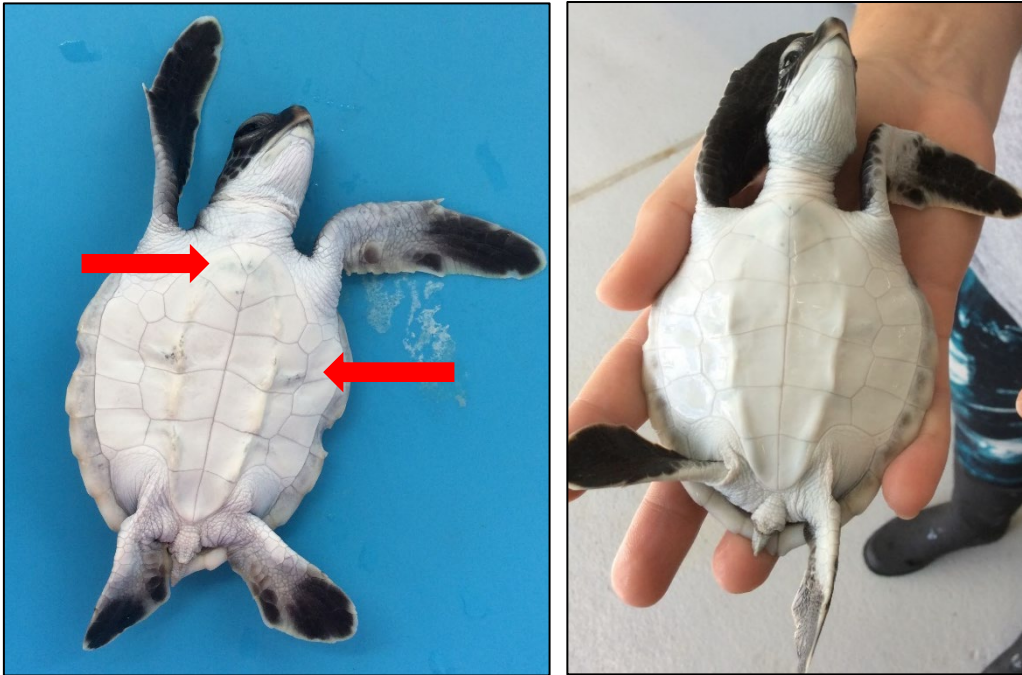


Figure 26. A) This turtle has a concave plastron. The shoulder bones and the pectoral girdle can be seen here. B) This turtle has a full plastron.

## Water quality

Water testing kits and test tubes are in the cold room on the shelf. Follow the instructions in the box to accurately analyse the water.

Inspect the tubes and ensure they are clean. Use the system's measuring cup for the water you wish to collect. First, rinse the test tube with the system's water by partially filling it, replacing the lid, and shaking vigorously for a few seconds. Discard this water as it's now wastewater. Fill the test tube until the indicated line (5 mL) and bring back to the work bench. Repeat this process for all the systems.

### pH

Acceptable levels should range between 7.5-8.5<sup>1</sup>. A decrease in pH is a good indicator for the need of a water exchange.

### Salinity

Acceptable levels are from 26 – 35 ppt; however, we want the salinity to remain around 35 ppt.

## Disinfect floors

Disinfecting the floors should be done at least every fortnight and as needed.

You will need the disinfectant, bins, brushes, and brooms. You will need the watering can to sprinkle disinfectant on the walking platforms to reduce the risk of splashing this liquid into the sumps. You can find the liter capacity of the bins on the bottom. The nelly bins used hold 54 liters. Knowing the bin capacity will help you calculate how much disinfectant you will need. For example, if you want to make a solution with the concentration of 1% disinfectant in the 50 liters, you will need 49.5 liters water and 500 ml of disinfectant.

Please remember to wear the gloves that are provided in the cold room when handling disinfectant.

## Disinfect refrigerator

Once a week the refrigerator needs to be disinfected. To minimize the growth of bacteria, always use a container to place defrosting food in and avoid leaving open containers in the refrigerator. Never use the refrigerator for personal food.

Use the labelled disinfectant spray bottle in the cold room and paper towel to wipe down. Please ensure you wipe down the roof, sides, and shelves in the refrigerator. Please wear the gloves provided in the cold room.

## Scrub hatchlings

Scrubbing the hatchlings is possibly the most interactive task that volunteers get to partake in; however this is not an opportunity to handle the turtles more than necessary or in a harmful way. We scrub the turtles to remove build-up that they would normally remove themselves in the wild by rubbing on objects and wave action. Plus, some turtles really seem enjoy a good carapace scratch!

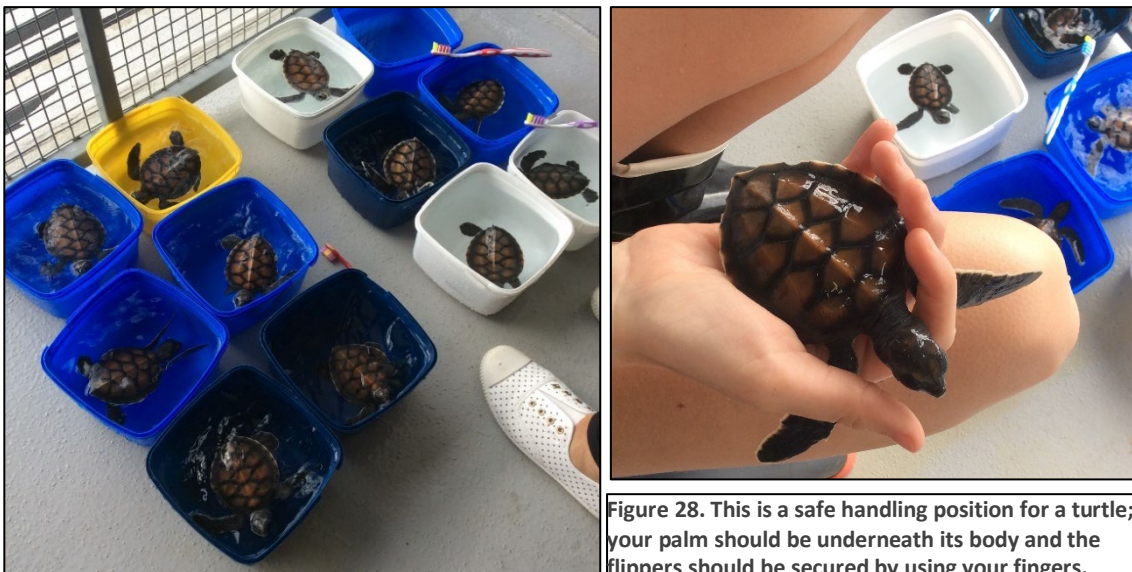


Figure 27. Turtles are scrubbed twice a week. Remember to rinse the turtles once you are done scrubbing them to remove skin particles.

Figure 28. This is a safe handling position for a turtle; your palm should be underneath its body and the flippers should be secured by using your fingers.

The turtles are scrubbed twice a week before feeding and basking (Figure 27). Collect the appropriate amount of toothbrushes from the container on the trolley next to the main sink. Use one toothbrush per turtle, but if you are in a pinch, using the same toothbrush for another turtle in the same system is OK. Ensure you have a container of soapy water to place used toothbrushes in.

Carefully pick up a turtle and hold it securely in your hand over their holding tank or in such a way that it wouldn't fall onto a hard surface if they should wiggle free (see *Turtle Identification and Handling*). Always practice safe handling techniques; you are likely to be holding the turtle for up to a few minutes. Be sure you are comfortable holding the turtle before you start (Figure 28).

Before you begin scrubbing, examine the turtle's dorsal side; do you notice anything strange? Are flaking scutes present? Are there any lesions? It is your goal to get rid of any loose material so natural growth can occur, but if there are any lesions, avoid scrubbing these areas. Take this opportunity to inspect the turtles and follow up on any abnormalities that have been flagged. Be sure to tell your team leader and write any new findings or updates on the daily task sheet.

Begin carefully scrubbing the turtle's head from back to front and avoid their eyes (Figure 29.A). As a reference, apply less pressure than you would use to brush your teeth. Then, carefully scrub the turtle's neck, shoulders, and flippers with the same amount of pressure as scrubbing the head. If a turtle is retracting their head, they are likely uncomfortable or stressed. If this happens move onto their carapace and attempt scrubbing their neck later.

After that, scrub the turtle's carapace (Figure 29.B). It is OK to apply a little more pressure when scrubbing the carapace; use the same amount of pressure you would use when brushing your teeth. You may also *gently* use your fingernail to test loose scutes. Please do not force anything that does not readily to come off.

Once you have finished the carapace, carefully flip the turtle over to scrub the plastron. Always turn a turtle over via its *right* side. Hold the turtle securely in your

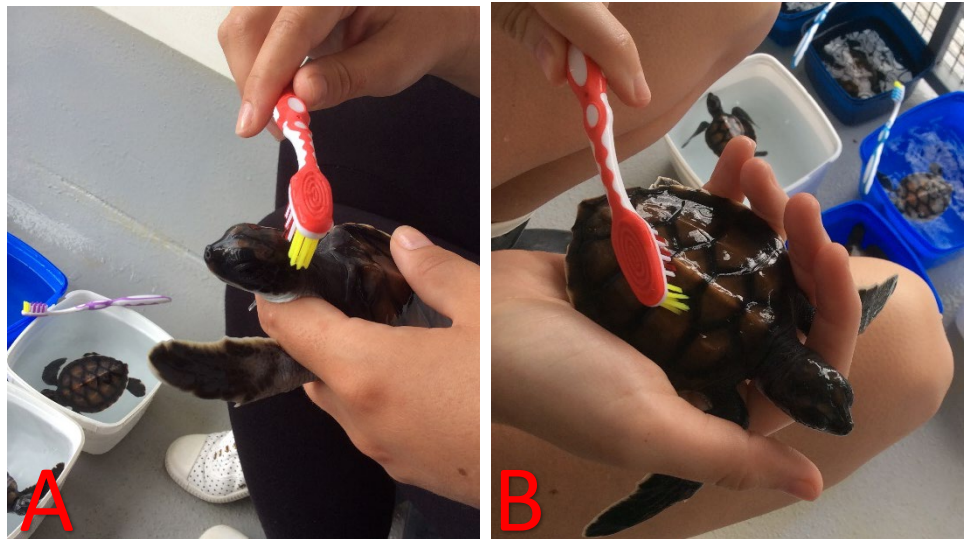


Figure 29. A) Ensure that you are mindful when scrubbing the turtle's head. Avoid the eyes and scrub *gently* from back to front. B) When scrubbing the carapace, it's OK to use a little pressure to loosen any scutes that are ready to shed.

hand and tilt upwards so it's not completely flat on its back (Figure 30). Many turtles seem to squirm for this part, so work efficiently. Observe the plastron and remove any loose particles. Gently scrub the area between the turtle's legs and carapace. Also, gently scrub between the legs and the cloaca. When you done scrubbing the plastron, flip the turtle back over via its *right* side.

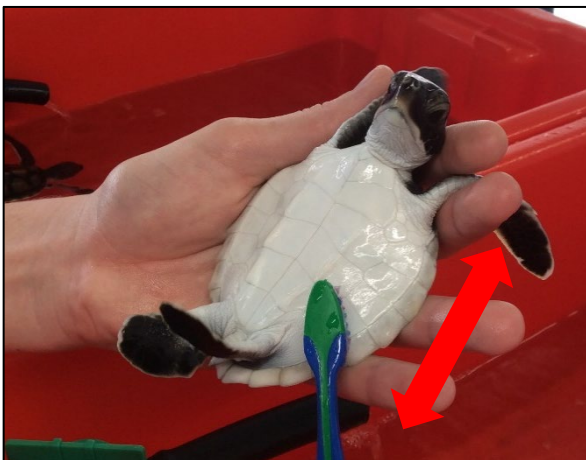


Figure 30. It is OK the same amount of pressure you would use to brush your teeth while scrubbing the plastron. Please be aware that the turtles are not comfortable on their backs, so work efficiently and quickly. Hold them tilted upwards and press your thumb gently on its chin to calm it down if necessary.

Once you have finished, place the used toothbrush into the soapy water container. Rinse the turtle under a gentle flow of water under a tap and safely put the turtle back into its home tank.

Repeat this process for all the turtles in the system. Rinse the equipment and wash your hands before moving onto the next system.

Remember to let the team leader know of anything abnormal with a turtle.

## Scrub juveniles

As the turtles get over 1 kg they become difficult to handle with one hand. The juvenile turtles can be encouraged to scrub themselves using a scrubbing apparatus or brushed with toothbrushes using two people.

Hold the scrubbing apparatus over the holding tank of the juvenile turtle (Figure 31). Be sure to stand out of view of the turtle but make sure you can still see the scrubbing brush. Monitor the turtle's behaviour to ensure they do not bite the scrubbing brush or are not startled by its presence.

The bristles of the brush should be just under the surface of the water. The turtles should interact with the brush to scrub their carapace and the top of their heads. If a turtle is not interested in the scrubbing brush after 5 minutes, move on to the next turtle.

There is one scrubbing apparatus per system. Ensure the correct brush is being used for the system.

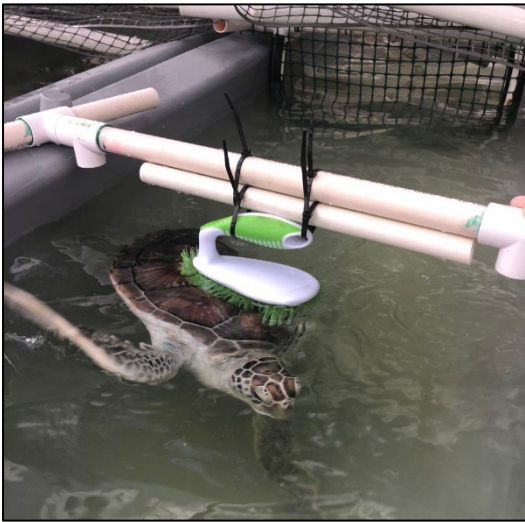


Figure 31: The scrubbing brush is held over the turtles holding tank so that the bristles are just below the surface of the water.

If you are scrubbing the turtles using toothbrushes, one person will have to hold the turtle with both hands while the other person gently scrubs the turtle. Follow the same toothbrush protocol as you do when the turtles are smaller.

In general, the hawksbill turtle's carapace grows more algae than the green turtles. This could be because the scutes are more porous, rough and provide more surface area for growth to occur.

Be mindful while handling the hawksbills and practice safe handling techniques. They have a longer neck and feistier personality than the docile greens. If a turtle becomes too unmanageable, do not force it on the turtle and return it to the water. Alert the team leader and note it down on the task sheet.

Another way to scrub the larger turtles requires two people – one to hold the turtle and the other to scrub the turtle (Figure 32). Follow the proper handling protocols under *Turtle Care*. You may still flip the turtle on its back to scrub the plastron. Remember to always turn the turtle over on via its *right* side.

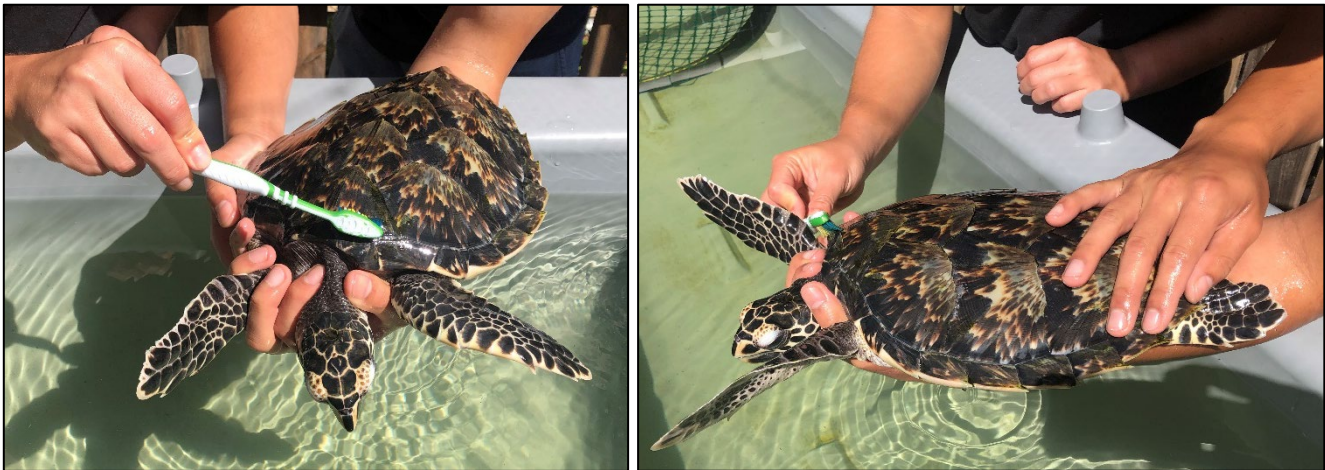


Figure 32. Scrubbing the larger turtles (weighing over a kilo) will require two people to scrub them. Use the safe handling techniques to make the turtle feel secure. Use the same scrubbing techniques as mentioned in the *Scrub Hatchlings* section above.

## Water Exchanges in the Caraplace

Water exchanges are essential to provide the turtles with the safest environment. Water exchanges for the hatchlings are conducted roughly once a month, or as required, and involve some planning.

First, ensure there is salt water in the holding tank outside. See “Add saltwater” for careful instructions for checking the saltwater content in the holding tank. Then, determine which systems are being done and put these turtles out to bask or in a safe area.

Once the turtles are safely out of their system, you can start draining the water.

1. First and most importantly, **make sure the electricity is off to all the equipment**. The lock out procedure mitigates this step, but please read below.
  - In the winter, keep in mind that if a heater remains in the system, it will be susceptible to breaking if exposed to significant changes in temperature or air (while switched on). **DO NOT EXPOSE A HEATER TO AIR THAT IS POWERED ON**. Leave the heater in the sump while it drains to allow it to cool slowly. After roughly ten minutes, you can gently scrub any organic material on the outside of the heater off while it’s in that bucket.
2. To drain the system:
  - Newer systems have an external standpipe. To drain these tanks, open the valve on the outside of the tank to empty it (Figure 33).
  - If there are standpipes, unscrew the standpipe in all six holding tanks. Unscrewing the standpipes can cause leaks; it is strongly encouraged to hold the bolt underneath the holding tank with one hand while unscrewing the standpipe inside the tank with the other hand (Figure 34.B). The water will begin to overflow in the sump quickly, so don’t be alarmed. When the tanks are empty enough to move, angle the tanks between the shelves so water can drain.
3. Remove materials from the tanks.
  - Set aside the drain plugs, platforms, and standpipes to be scrubbed later. Use a toothbrush to clean the inside of the standpipes.
4. Begin siphon hose in the sump
  - Start a siphon tube while the water level is still high. It’s our goal to remove as much of the saltwater as possible. **Pro tip:** During steps 5-7, frequently check the sump’s siphon hose to ensure it is still emptying. If another siphon hose is available, start a second siphon hose to speed up the process.
  - Siphon out any settling debris on the bottom of the sump.
5. Scrub and rinse the tanks
  - While the tanks are draining, begin scrubbing the tanks using the system’s brush to loosen any organic matter that is stuck to the tank.
  - Get the freshwater hose and rinse all of the tanks. Scrub the pump, pipes, and sides of the sump. Rinse the loosened waste with freshwater and use the siphon tube(s) to remove any solid organic waste. Once the water level is below the spill over hole, it will take time to siphon out the entire sump. Keep checking the sump for any settled matter so that it can be siphoned out.
  - Scrub the standpipe plug and platforms in soapy water practicing proper cleaning technique.
6. Clean the skimmers
  - Take this opportunity to scrub and clean the skimmer; ask the team leader how to disassemble the skimmer to scrub individual pieces. Fresh water is sufficient to clean these pieces. Do not stick the water pump in soapy water.
7. Prepare to add saltwater

- When you are ready to fill the system with saltwater place the tanks correctly on the shelf, and screw the standpipes back into place, remember to hold the disk underneath the tank when screwing the standpipe into place. Assemble the skimmer back together and into the proper position. Turn on the saltwater using the correct protocol found in “Add saltwater.”
8. Fill the system with saltwater
- This will be the slowest stage, but it’s important to keep a close eye on the saltwater level. It is important that one person is responsible for monitoring the water level so it does not overflow and waste water.



Figure 33. Newer systems have external standpipes that give us the flexibility to have water flow out of the tanks via the bottom or the side of the tank. To drain a tank that is using an outlet at the side of the tank (where red arrow is), turn the valve parallel to the poly pipe open to allow water to drain.

There is not necessarily a right way to fill the system, but here is a simple example:

- If it is the winter, do not direct the hose at the heater, even if it is off.
- Fill the sump until the water level reaches the skimmer’s intake pipe or spill-over hole.
- Begin filling the holding tanks and keep an eye on the water level in the sump.
- Be aware of the water level in the sump until the level is balanced. Again, the system is “full” when the sump’s water level is just below the spill over hole and all the holding tanks are filled to the standpipe.



Figure 34. A) If the bolt comes loose, the tank may begin to leak. This is the part you need to hold when unscrewing the standpipe. B) Hold the bolt in place while unscrewing the standpipe during a water exchange.

## Scrub holding tanks, sump and platforms

This task should be done before siphoning the tanks.

Fill an ice cream container with fresh water and pick a system to clean. Use the system's brush to dip into the fresh water and scrub the rim of the tanks, exposed sides, and cascade. Scrub the inside of the tank to loosen any organic material. Repeat this for all the tanks.

Once all the tanks and sumps are completed, scrub salt build-up off the poly pipe and fittings. Note any leaks that need attention.

Collect the standpipe plug and platforms from one system. Scrub them with the brushes that are kept at the sink. Practice the correct cleaning technique and return to the system. It does not matter which tank they're placed in, as long as it's within the same system.

After scrubbing the whole system, you're ready to siphon the loose material out of the tanks and sumps.

## IV. Tasks as Needed

### Trash

Remove all garbage every day from the cold room and as needed from the office. Garbage should be taken out nearly every day in summer and whenever food is made. The dumpster is in front of the Small Animal House (building 86) in the parking lot.

### Check Salinity

Check salinity every day at the start of husbandry. The salinity range should be between 27-35 ‰. Use Figure 35 as a reference and read the following instructions.

1. Use the refractometer to measure the salinity. It is in the dry box on the shelf in the cold room.
2. Ensure your hands are clean and dry before handling the refractometer. Zero the refractometer by placing 2-3 drops of distilled water (DI) on the prism using the pipette labelled 'DI H<sub>2</sub>O only'. Close the daylight plate and allow the prism to adjust to the temperature of the sample for 30 sec (important for accuracy). The sample should read 0ppt. If not, turn the calibration screw until the line reads 0ppt.
3. Clean the prism with designated refractometer cloth (located inside box) to prepare for the test sample from each water system. Practice biosecurity protocol when getting water from each system. Use your finger to drip 2-3 water droplets onto the glass. **DO NOT TOUCH THE GLASS** to ensure the prism glass is not scratched. **REMEMBER WHICH FINGER YOU USE FOR A SYSTEM AND DO NOT USE IT FOR ANOTHER SYSTEM.**  
Tip: ensure the entire prism is covered by the water sample and that there are no air bubbles when you close the daylight plate.
4. Read the salinity level by looking through the viewing window and read the scale on the right side. This measures salinity in ‰ (parts per thousand).
5. For normal daily measurements, note salinity in the appropriate table on the daily task sheet, for extra readings write measurements in the 'notes section'.
6. Repeat step 3&4 for all water systems with biosecurity in mind. i.e. ensure the prism is cleaned with the designated cloth (NO paper towels!) in between each salinity measurement and that a) clean hands between systems or b) use a separate finger for each system.



7. After all salinity measurements are taken, clean the prism by rinsing with DI water and dabbing with cloth. Clean the refractometer handle with *slightly* damp hand towel and drying with cloth. DO NOT immerse the refractometer in water or handle with wet hands as this will damage the instrument.

#### Storage

- Secure refractometer in the case and place box in the cool room.
- Distilled water must be stored in the Caraplace on the counter next to the clipboard (this ensures the water is at ambient temperature of the lab and aids in accuracy of measurements after calibration).

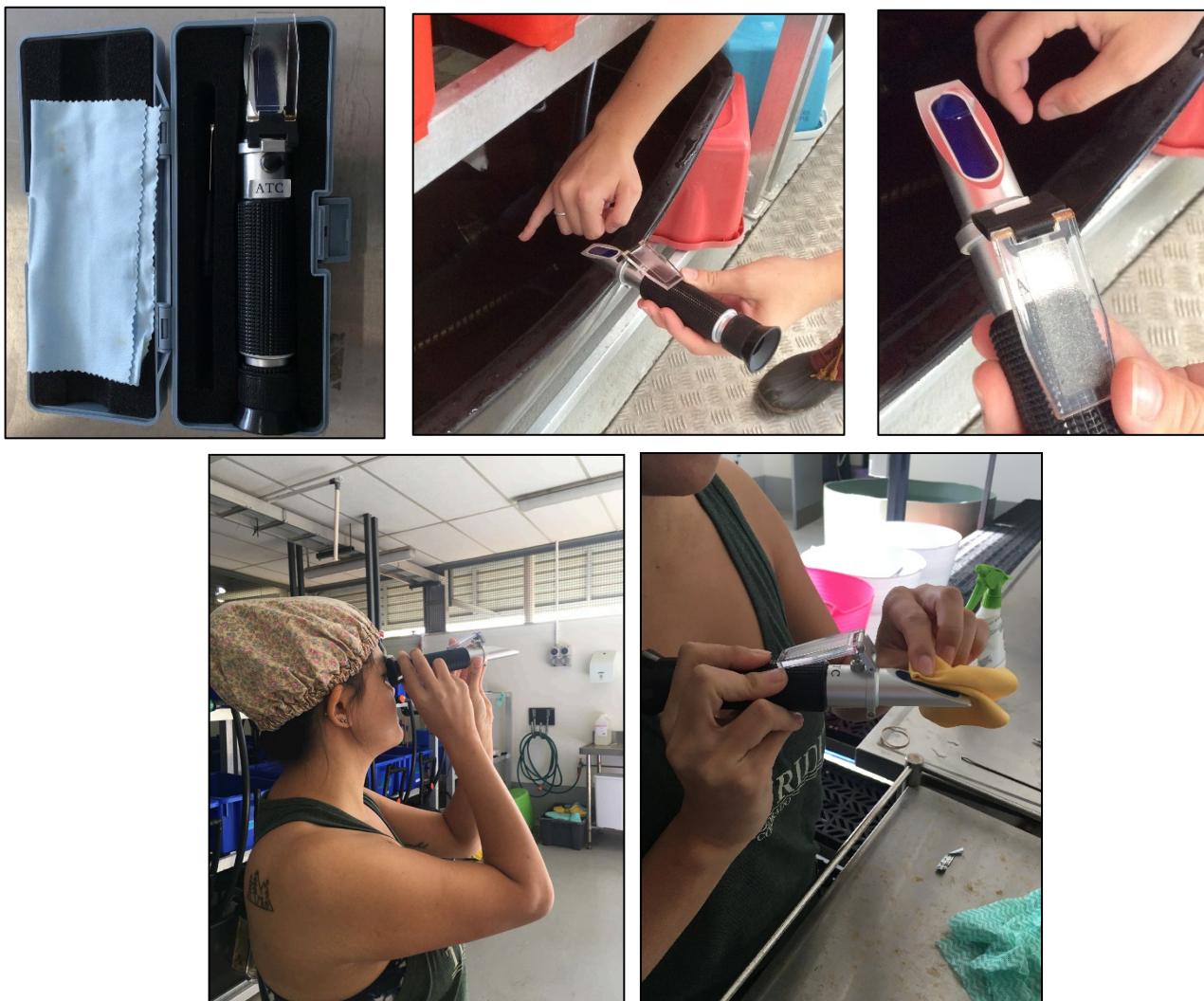


Figure 35. Use these photos to help your understanding of using the refractometer (starting at the top left in a clockwise fashion).

## Check temperature

There are cold nights during the winter months. We do our best to prepare for them by adjusting the heaters to cope with cool air and wind. In the winter months and cold spells check the temperature as soon as heaters are switched off at the beginning of husbandry.

In the summer months, there may be a need to adjust for extremely warm water. It is also important that water temperature remains within the range of 25-27.9°.

Refer to “Heaters” under “Technical Set-up” to find out more about adjusting the temperature settings on the heaters. To check the temperature, get the temperature reader from the dry box in the cold room. Tap the trigger gently to turn it on and then aim the instrument at where you’d like to obtain a reading from while holding the trigger down (Figure 36). A red laser indicates where the temperature is being read. Wait until the symbol in the top left corner stabilizes to record the reading. **NOTE: do not direct the laser at the sea turtles, especially their eyes.**



Figure 36. Use the heat gun to check the temperature in the sump or holding tank. Push the trigger and allow the reading to steady.

## Add water to the sump

At the end of the day, the sumps need to be topped up (Figure 37). The spill-over hole and the skimmer’s intake pipe are a good indication to an appropriate water level. The water should be just below the spill-over hole and covering the intake pipe on the skimmer.

Before adding the water, check the salinity levels using the refractometer. The salinity should range between 27-35 ‰; so, if the salinity is low, add saltwater. For systems C-H, there is a saltwater inlet plumbed into the sumps. Open the valve on the wall above the platform and open the valve on the appropriate system. The saltwater hose may also be used to fill the systems. The availability of saltwater in the reservoir tank can also determine if we can add saltwater. Typically, it’s not a problem.

**It is a biosecurity risk if the nozzle touches water within**

**the systems!** When filling the sump, do not let the nozzle touch the water in the system’s sump. It is important to remember to avoid targeting the nozzle towards the heater in winter because it may shatter the glass tube. Place the hose at the opposite end of the heater when filling. Refer to section below for the process of adding saltwater to sumps.



Figure 37. The hose nozzle should not touch the water within any system when adding water to the sump or to the tanks. This reduces any cross-contamination between systems.

## Add saltwater

The saltwater reservoir is located in an unclean area around the side of the building. **DO NOT WEAR LAB SHOES TO THIS AREA.** Carry your day shoes through the lab and put them on at the gate. Go through the wooden gate and check the beige coloured tank by knocking on the side; you can tell approximately where the water level is by listening for the solid knock of water (Figure 38.A) and feeling the tank for a difference

between cool and warm areas. Cooler areas indicate water on the inside of the tank whereas warmth indicates air. If the water level is close to/at/below the black marked line, let the lab technician know that a saltwater order must be placed.

Once you've confirmed there is saltwater in the reservoir, you may begin to open the valves and turn on the pump (Figure 38.B). Do not touch the valve with the red tag on it; this is the pressure release plumbing. The pipework goes back into the reservoir to ensure that while the pump is on and downstream valves are closed, there is no back pressure on the pump.

Remove the nelly bin from the pump. When "opening" the system, always start with the valve closest to the saltwater holding tank and work your way to the valve furthest away (1-3). To turn on saltwater: open the valves by turning them parallel to the pipes (Figure 38.C). Start with the valve closest to the reservoir (valve 1). Then, open the valve next to the pump (valve 2). Do not touch the pressure release valve. Turn the red valve on the side of the wall (valve 3) to the 'open' position. The saltwater valves inside are the last to be opened.

Plug in the pump to the outlet on the wall and switch the power on (Figure 38.D). Sometimes it may not start on the first try. If this happens, turn off electricity, wait fifteen seconds and switch it on again. If that doesn't work, there is an extension cord in the cold room. Use this to reach the electrical socket closer to the main gate.

Once you have entered the wooden gate to the facility, **change back into your lab shoes**. It is OK to leave your outside shoes on the concrete slab for later. **Wash your hands**. To fill the outside sumps, switch on the saltwater valve that is parallel to the pipe and watch the sump fill to prevent overflow. If algae is expelled into the sump from the saltwater pipe, use the fine blue nets to scoop it out and dispose of down the waste pipe between Neptune and Calypso systems.



Figure 38. A) The salt water holding tank is next to building 85. You can access it by going through the gate next to the Caraplace. B) The pump is located underneath the red bin (to protect from rain and sunlight). Do not touch the valve on the PVC plumbing that acts as a pressure release valve. There is a red tag on this valve. C) Open the valve closest to the salt water tank (1), then the red valve (2), then the red valve on the building to the Caraplace (3). When the valves are open, the handles will be parallel to the plumbing. Do not touch the pressure release valve. D) Plug in the pump. E) Open the saltwater valve inside the Caraplace to flush out sitting water. Then, transfer the hose from the fresh water spout to the saltwater valve.

There are a few valves that were installed to make filling systems more efficient (Figure 39). They are located on the far side of the lab at the end of the platform on the left side. Open up the valve that feeds into the Caraplace and open the sump valve to fill the sump. To make filling quicker, ensure the valve is closed to the Outer Shell (unless filling at the same time).

**Do not allow the hose's nozzle to touch the water already in the system.**

To turn off the saltwater: First, close the valves inside. Then, **remove lab shoes** to go outside. Turn off the pump, unplug and wrap the cord around the pump and arrange the electrical plug so the prongs are facing the ground (Figure 38.C). Close the valves by turning them perpendicularly to the pipes. First, close valve 3 on the wall (Figure 38.C). Then, close valve 2, then valve 1. You always start with the valve furthest away from the salt water reservoir and work your way back to the first handle when closing the valves (3-1). Place the nelly bin over the pump.



Figure 39: The Caraplace saltwater valve and a sump valve is displayed in the photo above.

Once back inside, **change back into your lab shoes and wash your hands**, and flush out the saltwater hose with freshwater by plugging the outlet back into the freshwater spout.

## Laundry

Hairnets must be always worn in the facility. Dirty hairnets are placed in the labelled bin near the lab entrance. Towels are used for various tasks in the Caraplace. Place used towels in the labelled bin provided near the entrance to the lab. Your team leader will transport dirty washing to the appropriate washing machine then dryer, located in building 87.111. Instructions are displayed for the washing machine and dryer next to the machines themselves (Figure 40).

The labelled bins in the lab are to remain in the lab and dirty washing/filters moved to a different bucket that moves between the storeroom and laundry. This way, dirty items are clearly kept separate from clean items.

### Laundry instructions

#### Towels and scrub caps

1. Bring dirty towels and scrub caps to the laundry when the baskets in the Caraplace are full. Baskets labeled "Dirty Towels" and "Dirty Hats" are next to the lab door. **IMPORTANT:** Please make sure there are enough clean scrub caps for the next day's husbandry and/or research team.
2. Put towels and scrub caps into the washing machine. Add 1 scoop of laundry powder directly to the washing machine. **DO NOT** put laundry powder into the cup in the center of the machine.
3. Wash towels and caps in **HOT WATER** on **REGULAR** mode.
4. When washing is done (approx. 1 hour), transfer the load to the dryer. **REMOVE LINT FROM FILTER.** Set the dryer for 60 minutes. When the cycle is complete, **CLEAN THE LINT FROM THE FILTER.**
5. Transfer towels and caps back to the Caraplace. Fold towels and put them in the cold room in the plastic tub. Put the caps in a neat pile on the table next to the lockers directly outside the lab door.
6. Put the buckets used for transport underneath the table in the small room of the office.

Figure 40. Instructions for doing laundry are located next to the washing machine in Building 87, room 111.

## V. Diet and Nutrition

It is important to note that the gelatin recipe is often modified to adjust for changes in ingredients. For example, a variety in protein and different gelatin brands impact the texture and firmness of the gelatin cube. When we change brands, sometimes the gelatin cube will disintegrate more quickly in the water before the turtle is able to eat it.

Modifying the recipe and changing our feeding behavior (one cube at a time) attempts to minimise nutrient loss. This recipe is already out of date, so please keep up with the team leaders.

Separate food batches are to be made for juvenile and hatchling turtles

**Hatchlings:** 162.5g protein => 3 cans of sardines split between three batches  
(ie 1 can of sardines in each blender)

Make up remaining weight with veggies

100g fish pellets => 50g of fish pellets + 50g of fish fillets

(Until remaining fish fillets are used up, then only 50g of pellets per batch and make up remaining 50g with veggies)

**Juveniles:** 162.5g protein => 2 cans of sardines split between 3 batches (remaining weight to be made up with veggies)

Fish pellets will no longer be used in juvenile food; replace this with 100g of veggies

**Corn, broccoli and cauliflower are NOT to be used.**

**Alternate which frozen vegetables are used between every batch to give the turtles a variety – this is important!**

**The following pages are recipes specific to hatchlings and juveniles and are located on the wall above the preparation bench in the cool room.**

## Turtle Food Preparation

**Please do not change recipe without consulting the Principle Investigator.**

**Ingredients** (take out ahead of time)

Item	Location	Amount per Hatchling batch	Amount per juvenile batch
Fish pellets	Right freezer	50g	-
Water (soaking pellets)	Tap water	50g	-
Fish fillets	Left freezer	50g (until gone)	-
Vegetables	Fridge/left freezer	~105g	~250g
Protein (Sardines)	Cans under bench	~132g (1 can per batch)	~90g (2 cans between 3 batches)
Gelatin	Bottom draw of fridge	50g	50g
Vitamins	Under bench	1/3 of tablet	1/3 of tablet
Water (for gelatin)	Hot water from kettle	350ml	400ml

### Hot water

- Note there is no hot water in the Caraplace, water must be boiled in kettle located in the cold room.
- Hot water is needed for washing up in the sink (several liters are required). Bring water to a boil, plug sink in the cold room, add detergent, pour boiling water, and add cold water to avoid burns. **Caution others that scorching water is in the sink.**
- Be careful to WAIT between boiling each kettle, as it may trip circuits. Please use the CB – 7 EDB85-3 electrical outlet for the kettle and the mixer; this is located above the freezer next to the sink.
- Avoid running both Nutribullet and kettle at the same time

### Hygiene

- Wash Hands thoroughly when entering cold room

- Wipe down benches with Ethanol spray before and after food preparation
- Collect all ingredients and place them on one side of the prep table
- Wash hands again before preparing food and after handling seafood
- If making a second batch, be sure to wash the mixing head with hot water and soap to use again. Cleaning the equipment is important to prevent the growth of harmful bacteria! If the sink becomes very dirty, please drain it! It is unhygienic to rinse kitchen equipment with dirty water! Place the clean equipment on the drying rack, or on a towel if space is limited, to air dry.

### Materials

- Nutribullet container (Large = one batch) & blade/lid
- Nutrient container (Medium; for weighing water)
- Mortar and pestle (to crush vitamin tablet)
- Small chopping board and/or plastic spoon (to separate vitamins)
- 2x small ice-cream containers (one for vegetables, one for protein)
- Large cutting board and knife (for defrosting/cutting larger vegetable and fish fillets)
- Small beaker or toothpick holder (for Gelatin)
- Large ice cube trays (to set food)
- Scales (for weighing)

## Hatchling food

### Methods

1. Measure 50g of **fish pellets** into Large Nutribullet container
2. Measure 50g of **tap water** in Medium Nutribullet container,
  - a. Pour into large Nutribullet container
  - b. Set aside to soak
3. Dice and measure 50g of **fish fillet** in small ice cream container
  - a. Pour into Large Nutribullet container mixture
4. Crush ONE **vitamin tablet** in Mortar & Pestle
  - a. Divide into three equal parts on small chopping board or using plastic spoon
  - b. Set aside
5. Measure 75g of **vegetables** in ice cream container
  - a. Pour into Large Nutribullet container mixture
6. Measure **1 can of sardines** (~110g) into ice cream container
  - a. Make up weight to 162.5g with **vegetables**
  - b. Pour into Large Nutribullet container mixture
7. Measure 55g **Gelatin** into small beaker/toothpick container
8. Measure **350 g** of **boiling water** into medium Nutribullet container
9. Simultaneously pour **Gelatin & boiling water** into Large Nutribullet container
  - a. All ingredients **EXCEPT vitamin** should be in mixture
10. Screw on Nutribullet blade/lid
  - a. Carefully turn upside down ensuring no leaks & lock into Nutribullet machine
  - b. Use 'Auto-iQ Smart Ultra Blend' (runs automatically for 60 seconds)
  - c. When finished open carefully right way up
11. Add 1/3 of **vitamin** tablet into Large Nutribullet mixture
  - a. Replace lid, lock into machine and run 'Auto-iQ Smart Ultra Blend' again
12. Set up Large ice cube trays on sterilised bench

13. Pour mixture into Large ice cube trays
14. Repeat Steps 1-13 two more times (to use whole vitamin tablet)
15. Carefully place ice cube trays into shelves of left freezer, avoid directly stacking
  - a. Already frozen food can be put into new ziplock bags and into fridge to defrost
16. Return all ingredients, wash all material in sink
  - a. Wipe down scales and Nutribullet machine with ethanol

**NOTE:** Use 300 ml boiling water with McKenzie's Gelatin powder

## Juvenile food

1. Crush ONE **vitamin tablet** in Mortar & Pestle
  - a. Divide into three equal parts on small chopping board or using plastic spoon
  - b. Set aside
2. Measure 175g of **vegetables** in Large Nutribullet container
3. Divide **2 cans of sardines** for three batches in ice cream containers (~90g sardines per batch)
  - a. Add **vegetables** to each batch to make up weight to 162.5g
  - b. Pour into Large Nutribullet container mixture
4. Measure 50g **Gelatin** into small beaker/toothpick container
5. Measure **300ml** of **boiling water** into medium Nutribullet container
6. Simultaneously pour **Gelatin & boiling water** into Large Nutribullet container
  - a. All ingredients **EXCEPT vitamin** should be in mixture
7. Screw on Nutribullet blade/lid
  - a. Carefully turn upside down ensuring no leaks & lock into Nutribullet machine
  - b. Use 'Auto-iQ Smart Blend' (runs automatically for 45 seconds)
  - c. When finished open carefully right way up
8. Add 1/3 of **vitamin** tablet into Large Nutribullet mixture
  - a. Replace lid, lock into machine and run 'Auto-iQ Smart Blend' again
9. Set up Large ice cube trays on sterilised bench
10. Pour mixture into Large ice cube trays
11. Repeat Steps 1-13 two more times (to use whole vitamin tablet)
12. Carefully place ice cube trays into shelves of left freezer, avoid directly stacking
  - a. Already frozen food can be put into new ziplock bags and into fridge to defrost
13. Return all ingredients, wash all material in sink
  - a. Wipe down scales and Nutribullet machine with ethanol

60% of the juvenile's food is in cubed, gelatinous form. The recipe for this is on the wall in the cold room, labelled 'juvenile turtles'.

Gelatin cubes may be defrosted in the fridge for feeding on the following day. Weigh the amount of food needed for all the systems in one day so we only defrost the necessary amount. To determine the relevant amount of food a system gets, refer to the *Feeding* section under *Daily Tasks*. Cubed food is to be prepared whenever stocks are low or if there is extra time after other husbandry duties have been completed. It is the team leader's responsibility to ensure the following day's team will have enough thawed cubed food. Once food has been made, place in the freezer overnight then ensure someone removes cubes from silicone moulds and place into zip-lock bags to store in the fridge.



40% of the juvenile's diet consists of a whole vegetable component. Frozen vegetables must be taken out of the freezer ahead of time to thaw in the fridge. This will avoid miscalculation of vegetable quantities from the water in frozen vegetables. Team leaders will prepare the correct amount of vegetables per turtle during husbandry each day.

References:

1. Bluvias, Jessie E. and Karen L. Eckert. 2010. Marine Turtle Trauma Response Procedures: A Husbandry Manual. Wider Caribbean Sea Turtle Conservation Network (WISECAST) Technical Report No. 10. Ballwin, Missouri, 100 pp.

# Outer Shell

## VI. Layout



The Outer Shell is a specially designed area in which the turtles bask to obtain essential Vitamin D and swim in larger enclosures. The Outer Shell has four separate systems, individually run by one life support system; this includes a sump, pump, UV filter, bag filter, skimmer, solids filter, and a heater during the winter months. The systems are different from those inside because the water flow is controlled by an *external* pump and there are additional pieces of equipment to ensure safe water for the turtles.

The Outer Shell operates by the same laboratory, safety and biosecurity standards as the Caraplace. In addition, this area is more ideal for visitors and tours coming through campus – visitors do not have to change shoes, inductions are simplified and it is easier to disinfect and clean outside than it is inside.

Please read the following instructions before commencing any tasks that must be completed in the Outer Shell.

## VII. Technical Set-up

Because the outdoor systems have an external pump, it is not necessary to turn off and lock out the electricity prior to commencing tasks in the water.

### Whole system set-up



Each system is named after an ocean God – Triton, Poseidon, Neptune, and Calypso. Each system has two troughs to hold no more than three turtles each; there are particular turtles that go into certain systems, just like in the Caraplace. Always pay attention to where the turtles belong.

Three turtles are able to swim more freely in each trough; the water is pushed into the troughs via the pump and exits via the drain, which is constructed of PVC pipe. The PVC drain plug is easily removed for cleaning purposes by unscrewing it along the threads. The water flows through the drain and into the sump where a bag filter is situated on the PVC pipe to catch large solids.

Figure 2 A. hose being used during husbandry on the water tap. B. the main wooden gate is latched back while anyone is inside the Outer Shell. This is because this is the only exit during husbandry or research. During events, the big wooden gate is open and the main gate is typically kept closed to prevent visitors from entering the Caraplace.

The water in the sump is pulled in through the pump and circulates through a series of pipes and mechanisms to clean the water. First, the water is pushed through a column filter (usually known as a bag filter), which contains a finer bag filter for smaller organic material. Once through there, the water travels through the UV filter. The water flows either directly to the troughs or into a skimmer. If the water goes through the skimmer, it is deposited back into the sump to be circulated through again.

In order to keep the water as clean as possible, please read through the following husbandry tasks.

## VIII. Husbandry tasks

### Rinsing station

Set up a rinsing station like the rinsing station inside the Caraplace. Biosecurity standards must be met in the Outer Shell; rinsing equipment and hands between systems are protocol!

Make up a soapy bucket and rinse buckets in the Outer Shell along the fence. Follow washing set-up protocol as per *Husbandry Tasks – I. Daily Routine, Step 5* and *Husbandry Tasks – II. Daily Tasks, Cleaning Equipment*.

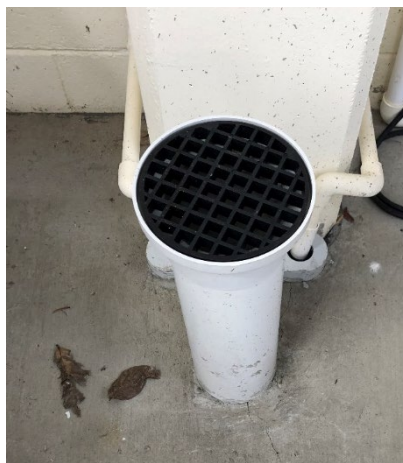
### Siphoning

To an extent, the bird netting, shade sails, and fences keep larger debris from coming into the Outer Shell. It is still really important to siphon out as much debris as possible that is blown into the systems from the surrounding environment. Pay special attention to larger objects that can be ingested, such as sticks or leaves, which may be harmful to the turtles if swallowed. Back burning also occurs on the surrounding mountains and embers can blow in; make sure to siphon or net out as much ash as possible.

Follow the same procedure for the siphon hose from Husbandry Tasks, II.

The waste water can go into the provided large bucket and down the drain, located between the third and fourth system, or be deposited onto the ground.

If turtles are fed in their tanks, it is important that uneaten food is removed. The food can disrupt the water quality and clog up the bag filters in the sump and the column filter. It is also important to remove faeces from the tanks. Siphon or brush out the tank outlet pipes as well. A lot of debris will collect here and not all will be expelled upon opening the waste valve.



## Bag filters

The bag filter attaches to the inlet pipes of the sump; this water is coming from the holding tanks and can have large bits of debris. To attach the bag filter, slide it over the pipes and secure it by hooking the wire hanger or zipties over the top of the pipes. Ensure that it is in a position that if the bag was to overflow, the water would run back into the sump and not out of the system.



To clean the bag filter, remove completely from the system and place upside down on the cleaning stand. Using a high pressure hose, spray down the outside of the bag, removing as much build-up as possible. Then, turn the bag inside out and repeat the same procedure. Once cleaned, return to the system. If, after cleaning, the bag still appears to be too clogged up for water to pass through, send the bag to the laundry to be cleaned with bleach. The bag will then need to be rinsed very well with freshwater before the bag filter can then be returned to the system.

There are also bag filters inside the column filter; they are cleaned in the same way.

## Waste valve

Each system has two waste valves that must be flushed daily to help prevent build-up of organic material. These are located between the main tanks and the sump and are controlled by a red tap. To flush these, place a bucket underneath the valve and then turn on the tap for five seconds. Otherwise, dispose the water down the drain between the 3<sup>rd</sup> and 4<sup>th</sup> systems (Neptune and Calypso).



## Column filters

The column filter, also known as a bag filter, is an essential piece of equipment to remove large debris from the system. In order for it to run efficiently, the column filter should be inspected and cleaned every day. Depending on the size and the feeding regime for the turtles being kept in these tanks, bag filters may need to be cleaned twice a day.

When visually inspecting the column filter, check for water escaping from the pressure valve, the black knob on the lid, and from underneath the lid. This indicates that the pressure valve is still open too much or there is something wrong with the seal.

**Pro tip:** Have a look at the skimmer. If water flow is traveling to the skimmer effortlessly, the skimmer will be producing many bubbles and pushing lots of water through, so long as all valves are opened correctly. If there are few, large bubbles, this indicates water is not being pushed through the system and there may be a blockage originating in the column filter.

To clean the bag filter inside the column filter follow these steps:

1. Stop water flow into the column filter.
  - This allows you to release pressure from inside the filter and twist the lid off.
  - It also restricts the water flow and reduces water loss from the system.
2. **SLOWLY** simultaneously open the “1” valve and close the “2” valve.
  - This stops water flow into the column filter and opens a bypass so water can keep flowing to the system
  - Notice the restricted water flow to the skimmer; there will be no bubbles until after performing the next step.
3. **SLOWLY** Close the “3” valve.
  - This restricts the water to back flow into the column filter
4. Twist the pressure valve open.
  - Water will start to flow out
5. Use the handles to twist the lid off
6. Remove the bag filter inside
  - Small white tabs keeping the bag filter in place may need to be rotated to remove the bag filter.
7. Take the bag filter to the cleaning rig to rinse using the pressure nozzle. The bag filter should be upside down on the rig.
  - First, thoroughly rinse the outside of the bag
  - Second, turn the bag inside out and thoroughly rinse the bag.
8. Return the bag filter to the column filter.
  - Turn the white tabs to keep the bag filter in place.
9. Replace the lid.
  - The threads on the lid and the column filter must “catch” in order to create a proper seal.
  - Ensure the lid’s thread is in front of the column filter’s thread. **REMEMBER** you are spinning the lid clockwise.
  - **PRO TIP:** When turning the lid, make sure the lid is level, and give it a quick spin using both hands on opposite sides.
  - **Line up the tape on the lid with the tap on the inlet pipe.** In some cases, there may be an “X” on the lid and inlet pipe.

10. **SLOWLY** simultaneously open the “2” valve and open the “3” valve.

11. **SLOWLY** close the “1” valve.

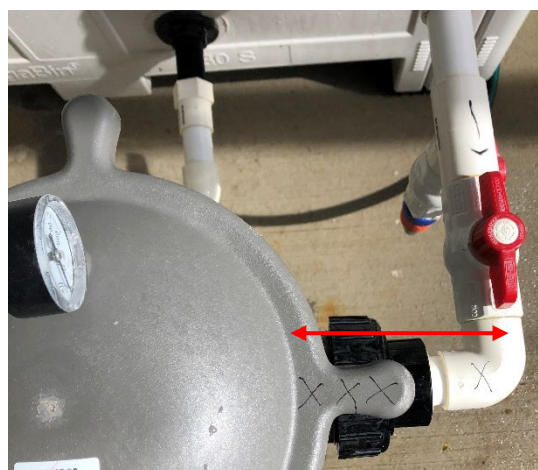
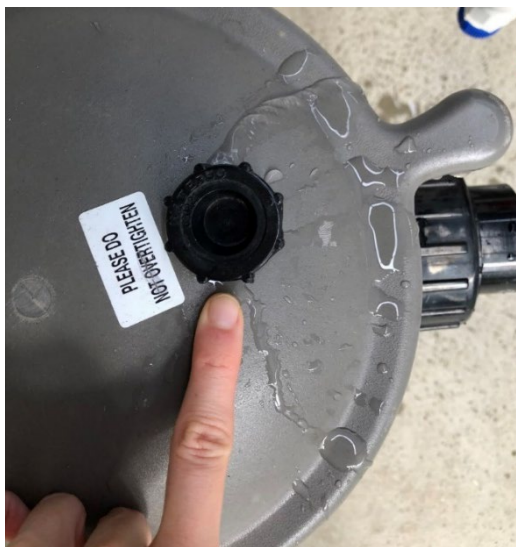
- Notice the water flow through the skimmer; after cleaning the bag filter, the skimmer should be working more efficiently.

12. Allow air to escape through the black pressure valve.

- A hissing noise can be heard while the valve is still open and air is escaping

13. Close the pressure valve to “hand tight” only.

- Once water is escaping through the valve, start closing the valve until water is not dripping out anymore.



## Skimmers

The skimmers serve the same purpose as to those in the Caraplace, but are constructed differently. They are located at the top of the sump on a metal platform. The skimmers must be cleaned regularly to perform optimally.

Waste cup cleaning:

- Unscrew the top lid (i) from the waste container(ii). **Note:** the screws are plastic, but may be rough on your hands; you may want to wear gloves or use a cloth to assist. Once the lid is removed, all surfaces should be scrubbed using a scrubbing brush to remove algal build up.



- **ONLY TAKE THE LID OFF – DO NOT REMOVE THE WASTE CUP UNLESS INSTRUCTED BY TECHNICIAN**
- Removing the waste cup break the seal between the main chamber and the waste cup. If the seal is broken, it's very difficult to reseal correctly and there will be leaks.
- Use a siphon hose and brush to remove particles that have been scrubbed off the surface.
- Another way to get debris out is to shut the skimmer's outlet valve; this causing an overflow into the waste cup and the debris is removed from the system. Open the outlet when you are finished
- Replace the lid onto the waste container and screw the plastic screws securely; it is not necessary to overly tighten these screws.
- Ensure the water flow, water level, and bubbles inside the skimmer are sufficient.
- If sufficient bubbles (either too much or too little) are not created, adjust the valves flowing directly to the skimmer. Caution must be used when altering the flow of these tanks, so as to not put too much pressure on the pump or water level in the sump and tanks. These parameters must be repeatedly checked after dealing with changes in water flow. It should also be noted that the water level of the sump must be at a sufficient level (reaching the ridge of the sump tank).

## Water Exchanges

Water exchanges are conducted on tanks to ensure water quality is held to a high standard. There is access to freshwater and saltwater in the Outer Shell. Chlorine bleach is also located in the Cold Room for decontamination when necessary. This task requires someone's full attention and should not be left alone.

- **TURN OFF THE ELECTRICITY TO THE HEATER AND UV FILTER BEFORE COMMENSING A WATER EXCHANGE. IT IS CRITICAL THE HEATER AND UV FILTER ARE NOT RUNNING WITHOUT WATER AND WATER FLOW. IN THE WINTER, PLEASE ALLOW THE HEATER TIME TO COOL OFF BEFORE EXPOSING TO AIR. THE PUMP MAY BE USED TO AID IN WATER EXCHANGES UNTIL A PARTICULAR POINT.**
- Please be aware the saltwater cannot flow into the parking lot. Make sure to empty the system as much as possible to the single drain between Neptune and Calypso. Use the spare hoses to attach to the water exchange and trough waste valve.

- Drop the water level significantly (*figure l*) by restricting the water flow to the bag filter. Close tap *ii* before the filter.



- Open Tap *iv* (*figure m*) to empty sump; a hose may also be attached to feed water to a more desirable location, such as the drain. The process may be sped up by re-closing tap *i*; however caution must be taken in doing so, as the pump may become overwhelmed.



- Open valve *vi* to empty troughs.



- When the sump and troughs are empty, rinse them with fresh water and take the opportunity to flush out PVC pipes by back flushing the pipes (sending water flow in the reverse direction it typically goes in) by using the freshwater hose. When the system is full and running it is also possible to manipulate the valves to increase flow in a particular direction – do not do this without the technician present.
- When ready to fill, close valves *iv*. and *vi*.
- Fill the sump with salt and/or freshwater until the water level in the sump and troughs are at equilibrium. The sump should be filled to the ridge and trough filled until just below the cascades.





- Turn the electricity on to all necessary equipment and ensure everything is working properly.

## SHADE SAILS



The shades are to be open when turtles are basking in the outside tanks. In the summer months, it is essential to monitor the temperatures of the troughs as they can heat up very quickly. The optimal temperature range is between 26-28° C. If temperatures are too hot, it is imperative to expose the troughs to direct sunlight. Discuss an appropriate solution with the team leader, the technician, and Principle Investigator.

To open/close the shades, ensure black ropes are untied from wall brackets. To open, pull rope closest to carapace wall. To close pull rope closest to outer shell wooden fence/wall. Once shade is open/closed, ensure ropes are securely tied off onto wall brackets. If the shades get stuck, try pulling the other rope then try again. If this doesn't work then you can use a long pipe or pole to gently push the awning.