

## AGRRA Detailed BENTHIC Protocol Version 5.5 Summary Instructions, April 2013

The **Detailed BENTHIC UW (Underwater) V.5.5** datasheet is formatted to be printed on 8.5x11" underwater paper ("DuraCopy" Copier/Laser Paper 6511). To reduce expenses, print this form on both sides of each sheet.

Each benthic surveyor should have a complete set of benthic survey equipment. Be sure to take enough **Detailed BENTHIC UW** datasheets when making more than 1 survey during any given field outing. Attach a copy of the **CORAL Codes-V5.5** list printed on UW paper to the underside of your clipboard or slate if needed for reference.

### **Complete before the dive.**

### **Site Information**

- Surveyor:** Name of the person making the survey or his/her 4-letter name code (e.g., John Smith = JOSM).
- Date:** Enter date as: day, month name, year (e.g., 19 Oct 09).
- Site Name:** Name of dive site or description of area (e.g., between Boston Beach & Splash Hotel).
- AGRRA Code:** Sequential site code (e.g., MEX007 = seventh Mexican site).
- How Selected:** Method used to select the site (e.g., stratified random, stratified strategic, strategic MPA site, etc.).
- Latitude & Longitude:** Latitude and longitude recorded for the site in degrees and decimal minutes, corrected if necessary from a boat or other fixed position. GPS waypoint may be recorded instead, but at least one datasheet per site should have the actual lat./long.
- Reef Type:** Type of reef system (e.g., bank, barrier, fringing, lagoonal, mid-shelf, patch, platform). *If different from expected, please describe the reef type surveyed.*
- Zone:** Reef zone surveyed (e.g., back, crest, fore). *If different from expected, please describe the reef zone surveyed.*
- Rel. Exposure:** Relative exposure to waves and wind as: windward, protected windward, leeward.
- Subzone/Habitat (if known before dive):** Topography & slope/dominant coral type(s): (e.g., rear/brains; breaker/dead *palmata*; spur & groove/*Orbicella* (i.e., ex-*Montastraea*); low-relief terrace lobes/small massive; slope/branching & massive; channel wall/plate & crust).
- Site Comments (e.g., location details):** Describe how latitude and longitude were calculated if estimated from some fixed position, or other notes about the site. Continue in margin if more space is needed.

**Lay First Transect Line.** Chose starting point **haphazardly**. Loop the free end of the line to a dead piece of coral or other secure object that won't easily be damaged. Unwind the transect line from the quadrat while avoiding the transect lines of other divers and reef edges, unusual reef features, abrupt slope changes, deep grooves and large patches of sand or rubble, unless instructed otherwise by the team leader. When the entire transect line is unwound, pull tightly to ensure that it is taut, and secure to the bottom by wrapping the quadrat around or over some sturdy object. As you return towards the starting point, straighten the line if necessary by repositioning one of its ends, by pulling it off the bottom in high-relief reefs or by disentangling it from upright octocorals, sponges, etc.

If the line sways a little due to strong surge or bottom current during the survey, note its position in the middle of its swing when locating the 10-cm points, or the center of the quadrats, or the midline of the belt.

*If lionfishes (Pterois spp.) are present, pay close attention to any that remain in the immediate vicinity of the transect line!*

### **Complete at the start of the first transect only (unless encountering water of a different temperature).**

- Start Time:** Time at the start of the transect.
- Bottom Temperature:** If you can: numerical value at the depth of the survey habitat; enter beside appropriate unit (°C or °F).

### **Complete at the start of each transect. Transect Information**

- Transect #:** Sequential number of the transect.
- Start & End Depths:** Depth of the transect line at the 0-m and 10-m marks; enter beside appropriate unit (ft or m).

### **Complete during each transect. Point Count Information**

**Points.** Record what is growing on the substratum at the marked 10-cm point intervals under the line between the initial mark at 0 m/0 cm and the 9 m/90-cm mark.

**Cover:** Use the CARICOMP-based codes for corals + DETAILED codes listed at the base of the UW datasheet + any additional codes considered necessary for the survey site.

If several organisms co-occur under a point (e.g., sparse TA among CCA; CYAN on FMA; FMA on CMA), record only the two most common with the uppermost organism first. Branching octocorals or ropy sponges: only record points that are directly above the area of attachment to the substratum. Record a newly fragmented coral as live or newly dead depending on its condition under the point. Record whatever is growing on the surface of dead coral rubble or dead corals. Code any sand-dwelling algae in sand as sand. If a point falls on drift algae or a motile animal, record whatever is

growing on the underlying substratum. If additional codes are considered necessary at the transect site, be sure to write an explanation in the Transect comments box.

On high relief reefs, if you can't locate the position of the point(s) to count by simple visual inspection:

**Above a narrow space**, hold the 1-m pole vertically below its position on the line and record what is beneath the pole.

**Above a wide space**, note on your UW datasheet which intervals are involved. If sand or mud, record as such and move on. If not, place your 1-m pole under the line and record what is growing on the substratum immediately adjacent to each 10-cm mark on one side of the pole in the "reserved" spaces on the UW datasheet (e.g., if from 4.5 - 5.3 m, for a total of 9 points).

Always put the category codes in the vertical rows matching the 0-90 marks in each meter. Then retrace your route to locate any missing points at the end of each meter—and add the appropriate code(s) in the remaining blank box(es).

**Macroalgal Heights:** **For a total of 2 transects**, record the heights of macroalgae under the points to the nearest nearest 1 cm if >1 cm (e.g., SAR/4 = 4 cm tall *Sargassum*), to the nearest .5 cm if <1 cm tall, or to the nearest .1 cm for encrusting macroalgae like *Lobophora*.

If several algae co-occur under a point, measure only the height of the total assemblage.

If macroalgae are scarce (i.e., cover < ~10 % of the substratum), try to measure their heights on all six transects.

### Quadrat Information

**Recruits, SC (Small Corals) and Substratum.** Unhook the quadrat and sequentially center it at 2-m intervals on the substratum beneath 5 of the meter marks while swimming back along the transect line. Brush loosely attached algae and sediment off the substratum and from any partially buried recruits or small corals. Search all surfaces in planar view in areas of high topographic complexity. Record:

**≤ 2 cm Recruits:** Total number for each species or genus (by code) or as UK if identity is unknown (e.g., 2SSID, 1UK = 2 *S. siderea* and 1 unknown). Write NONE if no recruits are seen.

**>2 - < 4 cm SC:** Total number for each species or genus (by code) or as UK if identity is unknown. Write NONE if no small corals are seen.

Ignore any < 4 cm remnants of formerly larger colonies.

**Substratum:** Code as **LC** for live coral, **DC** for dead coral, **RUB** for rubble (<30 cm, loose), **DCB** for dead coral boulder (>30 cm, loose), **PAVE** for carbonate pavement, **NCR** for non-carbonate rock, **SAND** for sand (least 5 cm thick), **MUD** for Mud (at least 5 cm thick).

Remember that only LC, Sand and Mud occur in both the Point Counts and Substratum. Record no more than two substratum types/quadrat. Hook the quadrat to the near end of the transect line when finished.

### Belt Information

**Motile Invertebrates, Lionfish and Trash.** Using the 1-m pole for scale, sequentially search a 50-cm wide belt on each side of the transect line between the 0 m/0 cm and the 10 m marks. Record any of the following:

**Juvenile *Diadema*:** Number of "juvenile" *Diadema* (small, with black-and-white banded spines). Put a 0 if none are seen.

**Adult *Diadema*:** Number of "adult" *Diadema* (larger, all-black spines, or all-black spines alternating with all-white spines, more rarely with all-white spines). Put a 0 if none are seen.

**Spiny Lobsters:** Number of Caribbean spiny lobster (*Panulirus argus*). Put a 0 if none are seen.

**Live Queen Conch:** Number of live queen conch (*Strombus gigas*). Put a 0 if none are seen.

**Lionfish:** Number of lionfish (*Pterois* spp.) Put a 0 if none are seen.

**Trash:** Number and kind of any trash items (e.g., fishing line, beer cans, engine block). Put a 0 if none are seen.

Summarize for the belt transect as a whole:

**Transect Comments:** Define any unique codes used (e.g., VALO = *Valoniopsis*). Add any other important observations about the transect (e.g., 2 spotted spiny lobster or 2 *P. guttatus*).

If any group of benthic organisms in the belt is conspicuously perturbed, note: its name or AGRR code; its approximate abundance by % cover or by number; and the approximate % cover or number affected by the perturbation (e.g., 35% PAL/ 50% BL = *Palythoa* covers 35% & 50% are bleached; 1/2 XES or BAR die = 1 of 2 *Xestospongia muta* or barrel sponges are dying).

When finished, rewind the transect line on the quadrat and continue to the next transect.

**Benthic teams should survey a total of 6 transects/site; more are acceptable.**

### **Complete by the end of the dive.**

**Site Comments:** Add any other notes about the site, including number of any lionfishes not in the belt transects.

**Subzone/Habitat:** (If determined during survey) as described above.

***Complete after the dive.***

**Data Entry & Backup**

Enter all your data, including any comments, on a daily basis in a copy of the **Detailed BENTHIC-Data Entry-V5.5** spreadsheet. **Use a separate copy of the spreadsheet for each site.** **Always back up your own data on a daily basis and store the files in a safe place.**

If you have invented any additional benthic codes: first check the complete list of Benthic Codes found in the **AGRRA Benthic Codes-V5.5** file and, if found, substitute for your code(s). If there is no pre-existing code, use your code(s) and be sure to include an explanation for each in the relevant transect or site comments.

**For detailed instructions, see AGRRA EQUIPMENT.PPT and AGRRA PROTOCOLS VERSION 5.5.pdf.**

## AGRRR Detailed CORAL Protocol Version 5.5 Summary Instructions, April 2013

The **Detailed CORAL UW (Underwater) V.5.5** Datasheet is formatted to be printed on 8.5x11" underwater paper ("DuraCopy" Copier/Laser Paper 6511). To reduce expenses, print this form on both sides of each sheet.

Each coral surveyor should have a complete set of coral survey equipment. Be sure to take enough **Detailed CORAL UW** datasheets when making more than 1 survey during any given field outing. Attach a copy of the **CORAL Codes-V5.5** list printed on UW paper to the underside of your clipboard or slate if needed for reference.

### **Complete before the dive.**

### **Site Information**

- Surveyor:** Name of the person making the survey or his/her corresponding 4-letter code (*e.g.*, John Smith = JOSM).
- Date:** Enter date as: day, month name, year (*e.g.*, 19 Oct 09).
- Site Name:** Name of dive site or description of area (*e.g.*, between Boston Beach & Splash Hotel).
- AGRRR Code:** Sequential site code (*e.g.*, MEX007 = seventh Mexican site).
- How Selected:** Method used to select the site (*e.g.*, stratified random, stratified strategic, strategic MPA site, *etc.*).
- Latitude & Longitude:** Latitude and longitude recorded for the site in degrees and decimal minutes, corrected if necessary from a boat or other fixed position. GPS waypoint may be recorded instead, but at least one datasheet per site should have the actual lat./long.
- Reef Type:** Type of reef system (*e.g.*, bank, barrier, fringing, lagoonal, mid-shelf, patch, platform). *If different from expected, please describe the reef type surveyed.*
- Zone:** Reef zone surveyed (*e.g.*, back, crest, fore). *If different from expected, please describe the reef zone surveyed.*
- Rel. Exposure:** Relative exposure to waves and wind as: windward, protected windward, leeward.
- Subzone/Habitat (if known before dive):** Topography & slope/dominant coral type(s): (*e.g.*, rear/brains; breaker/dead *palmata*; spur & groove/*Orbicella* (*i.e.*, ex-*Montastraea*); low-relief terrace lobes/small massive; slope/branching & massive; channel wall/plate & crust).
- Site Comments (*e.g.*, location details):** Describe how latitude and longitude were calculated if estimated from some fixed position, or other notes about the site. Continue in margin if more space is needed.

**Lay Transect Line.** Chose starting point **haphazardly**. Loop the free end of the line to a dead piece of coral or other secure object that won't easily be damaged. Unwind the transect line from the quadrat while avoiding other transect lines and reef edges, unusual reef features, abrupt slope changes, deep grooves and large patches of sand or rubble, unless instructed otherwise by the team leader. When the entire transect line is unwound, pull tightly to ensure that it is taut, and secure to the bottom by wrapping the quadrat around or over some sturdy object. As you return towards the starting point, straighten the line if necessary by repositioning one of its ends, by pulling it off the bottom in high-relief reefs or by disentangling it from upright octocorals, sponges, *etc.*

If the line sways a little due to strong surge or bottom current during the survey, locate the midline of the belt by noting its position in the middle of its swing.

*If lionfishes (Pterois spp.) are present, pay close attention to any that remain in the immediate vicinity of the transect line!*

### **Complete at the start of the transect.**

### **Transect Information**

- Start Time:** Time at the start of the transect.
- Bottom Temperature:** If you can: numerical value at the depth of the survey habitat; enter beside appropriate unit ( $^{\circ}$  C or  $^{\circ}$  F).
- Start & End Depths:** Depths at the 0-m and 10-m marks; enter beside appropriate unit (ft or m).

### **Complete during the transect.**

Starting on one side of the line, survey all  $\geq 4$  cm stony corals, except for *Millepora alcicornis*, for which any part, no matter how small, is located inside a 50-cm-wide belt between the 0-m and the 10-m marks, as specified below. Ignore dead corals that can no longer be identified at least to the genus and dead branching corals in which most of the branches are missing. Then continue in a 50-cm-wide belt on the 2nd side of the transect line, being careful not to resurvey corals that are under the line.

In high-relief reefs it may be easier to survey both sides of the line at the same time. However, you should still try to spread your assessment along the line in reefs containing too many corals to complete the entire 10 m<sup>2</sup> survey within one dive. **Optional:** *Before the dive, you can randomly write the numbers between 0 and 9 on your datasheet to determine the order of surveying the meters along the line.*

If survey cannot be completed during one dive (e.g., due to a large number of corals), tally by species all remaining  $\geq 4$  cm corals as colonies, clumps or fragments.

**Coral Terms. Colony:** one genetic individual, even if the soft tissues naturally divide into separate units. Colony margins can be difficult to recognize when parts of a coral have died and are overgrown by other organisms—particularly other corals of the same species. Look for connected live tissues, basal skeletal connections, and at the size and color of the separated tissues. Put any **solitary** *Scolymia* here.

**Clump** (i.e., thicket or cluster): a group of similar appearing corals of the same species for which individual colony borders are indistinct. Many are branching species, but can also include large groups of lobate corals like *O. (ex-M.) annularis*.

**Fragment:** detached coral, often broken and easily moved; unlikely to remain in its current location for long.

### Information for Each Surveyed $\geq 4$ cm Coral

**Species Code:** Record its 4-letter CARICOMP-based coral code (e.g., CNAT = *Colpophyllia natans*). Use genus code if unsure of species (e.g., ORBI for the *O. annularis* complex).

Sketch and briefly describe any unfamiliar corals and try to identify after the dive. Include any standing dead corals that can be identified at least to genus and for which the original size can still be estimated.

**# Isolates, or put CLUMP or FRAG:** If a **colony**, put the total number of soft tissue isolates resulting from prior or ongoing perturbations. Put 0 if entire colony is standing dead, i.e., skeleton is intact but has no live tissues. Put 1 if the soft tissues lack externally produced sub-divisions. If  $>10$ , estimate to the nearest 5 as 15, 20, etc. Ignore the isolates that form naturally in some species (e.g., *O. annularis*, *P. porites*, *M. angulosa*).

If a **fragment** or **clump**, do not count isolate number but write FRAG or CLUMP, respectively.

Colony margins (needed for # isolates and max. sizes) can be difficult to recognize when parts of a coral have died and are overgrown by other organisms—particularly other corals of the same species. Whenever possible, look for connected live tissues, basal skeletal connections, and at the size and color of the separated tissues.

### Each Surveyed $\geq 4$ cm Colony, Solitary Coral and Clump (Ignore Fragments)

**Max. Size (cm).** As appropriate for the corals' size, use the ruler, 50-cm pole or 1-m pole to measure its maximum dimensions, as seen in planar view, to the nearest 1 cm up to 10 cm, to the nearest 5 cm up to 50 cm, to the nearest 10 cm up to 200 cm, to the nearest 20 cm up to 500 cm, and the nearest 50 cm if  $> 5$  m (some large clumps). Record:

**Length:** Maximum length perpendicular to the axis of growth in cm.

**Width:** Maximum width at right angles to the maximum length in cm.

**Height:** Maximum height parallel to the axis of growth in cm.

Measure the maximum sizes of large colonies and clumps even when they extend outside the belt transect.

How to assess colonies, solitary corals or clumps that are detached from the substratum:

**If loose**, and large enough to remain in place during all but severe storms, measure size as if still attached. You can write LOOSE in the corresponding Comments box.

**If loose but wedged** (i.e., likely to remain in this position for an extended period), measure size as if attached in the "new" position. You can write WEDGE in the corresponding Comments box.

**If fallen and reoriented** to grow upward in a new position, measure the "new" size dimensions.

### Outward-Facing Surfaces of Each Colony and Solitary Coral (ignore Clumps and Fragments)

**Condition<sub>a</sub>.** Estimate each of the following on the outward-facing surface of each colony or solitary coral to the nearest 5% (e.g., 35%) unless very small or very large—in which case try to round to the nearest whole number (e.g., 3%, 99%). Can leave blank if 0%.

**% Bleach:** The percent of the entire planar surface (**and not just the proportion of live tissues**) that is **P** (pale) and/or **BL** (fully bleached) (i.e., 30P, 10BL = 30% pale + 10% bleached).

[Alternatively, some groups have qualitatively approximated the severity of any discoloration as **P** (pale) and/or **PB** (partly bleached = patches of fully bleached tissues), or **BL** (all tissues are fully bleached).]

Remember that some bleached corals have fluorescent purple, pink or blue colors.

**% Partial Mortality:** The percent of the entire planar surface that is:

**New** for any new mortality—skeletal structures are intact unless live tissues have just been bitten by a fish or abraded and have no sediment, bacterial/microalgal biofilms, turf algae, etc., on their bright white surfaces; and/or

**Trans** for any transitional mortality—skeletal structures are slightly eroded at most and covered with fine layer of sediment, microbial/microalgal biofilms, or tiny turf algae—unless they have just been bitten by a fish or abraded, thereby exposing the underlying bright white skeleton; and/or **Old** for any old mortality—skeletal structures are completely covered over by organisms that are not easily removed, e.g., thick algal turfs, many macroalgae and invertebrates—unless they have just been bitten by a fish or abraded, thereby exposing the underlying, bright white skeleton.

Although most large colonies have some dead areas, ignore any that are restricted to the sides or bases, and thus not visible when their outward-facing surface is viewed from above. Can leave blank if 0%.

When corals are partially or completely overgrown by a brown or black zooxanthellate clonid sponge, the live coral polyps are replaced by sponge tissues with their characteristic ostia and oscules (openings). Even though the coral skeleton may be visible beneath the sponge, include the affected area in your estimate of old mortality, and note CZOO OG (=zooxanthellate clonid overgrowth) in the Comments box.

### **Outward-Facing Surfaces of Each Clump (Ignore Colonies, Solitary Corals and Fragments)**

**Condition<sub>b</sub>.** In the Comments cell, tally the condition of points at regular intervals across the maximum length (Max L) of each clump with the 50-cm or 1-m pole for scale, using the following codes:

**Comments:** **L** for number of points over live tissues with "normal" pigmentation; **P** for number of points over pale live tissues; **BL** for number of points over fully bleached live tissues; **NM** for number of points over new mortality; **TM** for number of points over transitional mortality; **OM** for number of points over old mortality (includes other organisms overgrowing dead parts of the clump); **OTHER** for number of points over anything that is not part of the clump (e.g., 15 L, 3 P, 4 TM, 8 OM, 5 OTHER = 15 live, 3 pale, 4 transitional mortality, 8 old mortality, for  $\Sigma$  30 points across the clump's Max L and 5 points not on the clump).

Suggested interval lengths: 5-cm up to 1 m max L; 10-cm from 1 - 2 m Max L; 20-cm from 2 - 5 m Max L; 50-cm from 5 - 10 m Max L; 1-m for > 10 m Max L. Note the interval length used.

### **Entire Surfaces of Each Colony, Solitary Coral and Clump (ignore Fragments)**

**Condition<sub>c</sub>.** Examine the entire surface of each colony, solitary coral and clump. Record the presence (but not %) of any disease. Can leave blank if 0%.

**Disease:** Any conspicuous tissue loss as  
**CBD** (Colored Band Diseases), or distinguish as **BB** (Black Band), **RB** (Red Band), or **CCI** (Caribbean Ciliate Infection), or as  
**WDS** (White Diseases or Syndrome):  
If not *Acropora*, try to distinguish as **WP** (White Plague) or **CWS** (Caribbean White Syndrone = not WP);  
If *Acropora* as **AWDS** (Acroporid White Disease/Syndrome), or try to distinguish as **WB** (White Band), **WPD** (White Patch Disease, formerly coded as WS), or **RTL** (Rapid Tissue Loss).  
Any conspicuous tissue discoloration as—  
**DS** (Dark Spots Syndrome), **YB** (Caribbean Yellow Band).  
Any conspicuous tissue anomalies as—  
**GA** (Growth Anomaly), or **GI** (Gigantism).  
Put **UK** when an unknown disease or as instructed by the team leader. Can photograph or describe unknowns.

### **Sides of Each Colony, Solitary Coral and Clump (ignore Fragments)**

**Condition<sub>d</sub>.** Examine the sides of each coral and note the presence (but not %) of any bleaching or mortality only if not already recorded on the outward-facing surface of colonies and solitary corals or under the counted points of clumps.

**Any "Extra"** Any "extra" bleaching as **P** for pale and/or **PB** for partly bleached, or as **BL** for fully bleached.  
**P, PB, BL,**  
**NM, TM, OM** Any "extra" mortality as **NM** for new mortality, and/or **TM** for transitional mortality, and/or **OM** for old mortality.  
**SD:** Put **SD** if the entire coral is standing dead (= complete, 100% mortality) and you can identify it to species, species complex, or genus by gross morphology and/or by polyp size, shape and arrangement.

### **Entire Surfaces of Each Colony, Solitary Coral and Clump (ignore Fragments)**

**Comments + POINT COUNTS (clump);** Space is available here for any other relevant observations about the coral.  
**LOOSE, WEDGE;** If a clump, point counts and point-count intervals are entered here.  
**Any Predators,** If detached, can note as **LOOSE** if in original growth position, or **WEDGE** if wedged in reef.  
**Major Competitors,** If possible, note the effects of any predators, e.g., **PFB** for Parrotfish Bites, **DFB** for Damselfish Bites, **DFG** for Damselfish Algal Gardens, **CABB** for short coral snail, *Coralliophila abbreviata*, **CAR** for bristle worm, *Hermodice carunculata*.  
**CHC:** If possible, note any major competitors by name or AGRRA code.  
If appropriate, note any unhealthy looking tissues as **CHC** for compromised coral health.  
If coral is photographed, note image number here.

Periodically check your bottom time and air supply. If remaining time and available air both permit, after completing the belt on one side of the line, return along the second side, assessing all  $\geq 4$  cm corals that are at least partially within a

0.5-m wide belt. **Be careful not to resurvey any coral beneath the line that was examined during the first transect.**

**Area Surveyed (m<sup>2</sup>):** When finished surveying, record the total number of square meters with completed surveys of all  $\geq 4$  cm stony corals.

**Remember that the area between each 1-m mark on one side of the transect line = 0.5 m<sup>2</sup>.**

#### Information for Each Tallied $\geq 4$ cm Coral

If at any time during the dive you don't have enough time and/or air left to complete the survey, use any blank spaces remaining on your datasheet to tally the numbers per species of any remaining  $\geq 4$  cm colonies, clumps and fragments in the belt transect using their 4-letter CARICOMP-based coral codes (e.g., COL: OFAV ### II, CNAT IIII; CLUMP: PPOR II; FRAG APAL I = 7 colonies of *O. faveolata*, 4 colonies of *C. natans*, 2 *P. porites* clumps and 1 *A. palmata* fragment). Record these data on any open space left on your datasheet.

**Area Tallied (m<sup>2</sup>):** When finished tallying, record the total number of square meters in which all  $\geq 4$  cm stony corals were tallied by species and as colonies, clumps or fragments.

#### Complete by the end of the dive: Comments

**Transect Comments:** Define any unique codes used (e.g., MADR = *Madracis* species unclear). Add any other important observations about the transect, including number of any lionfishes.

If any other group of benthic organisms in the belt is conspicuously perturbed, note: its name or AGRRA code; its approximate abundance by % cover or number; and the approximate % or number affected by the perturbation (e.g., 35% PAL/ 50% BL = *Palythoa* cover is 35% & 50% are bleached; 1/2 XES or BAR die = 1 of 2 *Xestospongia muta* or barrel sponges are dying).

**Site Comments:** Add any other notes about the site, including number of any lionfishes not in the belt transect.

**Subzone/Habitat:** (If determined during survey) as described above.

#### Coral teams should survey a total of 2 transects; more are acceptable.

#### Complete after the dive: Data Entry & Backup

Enter all your data, including any comments, on a daily basis in a copy of the **Detailed CORAL-Data Entry-V5.5** spreadsheet. **Use a separate copy of the spreadsheet for each site. Always back up your own data on a daily basis and store the files in a safe place.**

If you have invented any additional descriptive codes: first check the complete list of Benthic Codes found in the **AGRRA Benthic Codes-V5.5** file and, if found, substitute for your code(s). If there is no pre-existing code, use your code(s) and be sure to include an explanation for each in the relevant transect or site comments.

**For detailed instructions, see AGRRA EQUIPMENT.PPT and AGRRA PROTOCOLS VERSION 5.5.pdf.**

## **AGRRR Detailed FISH Protocol Verion 5.5 Instructions for Use, April 2013**

Two versions of the **Detailed FISH UW (Underwater) V.5.5** datasheets are available: one each for common English and scientific names. Choose one version and use it for both training and surveys. Each is formatted to be printed on 8.5x11" underwater paper ("DuraCopy" Copier/Laser Paper 6511). To reduce expenses, print this form on both sides of each sheet.

Each fish surveyor should have a complete set of fish survey equipment. Be sure to take enough **Detailed FISH UW V5.5** datasheets when making more than 1 survey during any given field outing. Attach a copy of the **UW Fish List-V5.5** printed on UW paper to the underside of your clipboard or slate if needed for reference.

### ***Complete before the dive.***

### **Site Information**

Be sure to write your initials (or name), the date, site name and AGRRR (site) code on **EACH** datasheet used during the dive.

- Surveyor:** Name of the person making the survey or the corresponding 4-letter code (e.g., John Smith=JOSM). Put at least once on each side of every datasheet.
- Site Name:** Name of dive site or description of area (e.g., between Boston Beach & Splash Hotel). Put at least once on each side of every datasheet.
- AGRRR code:** Sequential site code (e.g., MEX007 = seventh Mexican site). Put at least once on each side of every datasheet.
- Date:** Enter date as: day, month name, year (e.g., 19 Oct '09). Put at least once on each side of every datasheet.
- Latitude & Longitude:** Latitude and longitude recorded for the site in degrees and decimal minutes, corrected if necessary from a boat or other fixed position. GPS waypoint may be recorded instead, but at least one datasheet per site should have the actual lat/long.
- Site Comments:** Describe how latitude and longitude were calculated if estimated from some fixed position, or other notes about the site.

**Choose transect starting point.** Haphazardly choose a starting point for each transect by placing the weighted end of the tape in a small crevice so it won't drag when the reel stops. As much as possible, given the shape and size of the reef at the survey site and the prevailing visibility conditions underwater, avoid the other fish surveyor(s) and the divers with transect lines on the substratum. Clip the reel to the D-ring or clamp on your weight belt or BCD to allow the tape to be easily released while swimming.

**Complete at the start of the first transect only (unless encountering water of a different temperature).**

**Bottom Temperature:** If you can: numerical value at the depth of the survey habitat; enter beside appropriate unit (° C or ° F).

### ***Complete at the start of each transect.***

### **Transect Information**

- Transect #:** Sequential number of the transect.
- Start Time:** Time at the start of the transect. Use to ensure that you are swimming at a steady pace of about 6 minutes/transect.
- Start Depth:** Depth at the start of the transect; enter beside appropriate unit (ft or m).

### ***Complete during each transect.***

### **Fish Information**

**Fish counts.** Swim in a straight line, at a steady pace about 2 m above the substratum, while releasing the 30-m or 100 ft tape, holding the T-bar in front for scale, and giving uniform attention to each successive, 2-m long segment of the transect. (On shallow reefs, it may be necessary to swim closer to the substratum.) Within each 2-m long segment, count all fishes listed on the AGRRR **Detailed FISH UW V5.5** datasheet that are within a 2m-wide belt extending from the substratum into the overlying water column. Estimate the total length of each fish using the 10-cm increments on the T-bar for scale, and assign it to one of the following size classes: 0 - <5 cm; 6 - 10 cm; 11 - 20 cm; 21 - 30 cm; 31 - 40 cm; or any appropriate 10-cm increment above 40 cm—write the latter in the column for > 40 cm. If individuals within a single size class are so abundant that you need to expand into an adjacent cell or cells, be sure to draw an arc around the additions that clearly shows to which size class they belong.

Use hash marks when counting few fishes, and whole numbers separated by commas or some other delimiting mark for schools (e.g., ###-III, 30, 20 = 58). Put large schools into one or more size classes and approximate the numbers of individuals to the nearest 10 or 100. Remember to count only those members of a school that happen to be within the 2-m long segment that is immediately in front of you at any given time. *You may pause while recording data, and then start*

swimming again. It is important to swim in a uniform manner. A speed that covers each 30-m transect in about 6 minutes should be attempted, however, high densities of AGRRA fishes could slow this pace.

In addition to counting, briefly describe and sketch any unknown/unfamiliar fish in the margin of the UW datasheet. Body shape and behavior (e.g., swimming with pectoral fins, lying on bottom) may help later to identify its family. Colors and notable markings (spots, lines, etc.) can be essential in determining the species.

To conduct a survey you must be able to identify the AGRRA Detailed-level fishes by either their common English or their scientific names. Frequently encountered species and families are listed on the **Detailed FISH-UW-V5.5** datasheets. Fill in the name of any unlisted AGRRA species present at the site in the appropriate blank space associated with its family, or in any other blank space on the datasheet.

**AGRRA Detailed-level Fishes by English Common Name:**

**ALL Western** in these families—Angelfish, Butterflyfish, Grunt (score all < 5 cm long by family name only),  
**Caribbean Species:** Parrotfish (score all < 5 cm long by family name only), Sea Bass (Grouper subfamily only), Snapper, Surgeonfish, Triggerfish, Moray.

**LISTED Western** hogfish, puddingwife, slippery dick, Spanish hogfish, yellowhead wrasse; orangespotted  
**Caribbean Species:** filefish, scrawled filefish, whitespotted filefish; balloonfish, porcupinefish; jolthead porgy, pluma, saucereye porgy, sheepshead porgy.

**Other Species:** bandtail pufferfish, bar jack, chubs (Bermuda &/or yellow), great barracuda, permit, spotted trunkfish, threespot damselfish, yellowtail damselfish, lionfishes (common &/or red lionfish)

**AGRRA Detailed-level Fishes by Scientific Name:**

**ALL Western** in Acanthuridae, Balistidae, Chaetodontidae, Haemulidae—all species except *Haemulon*  
**Caribbean Species:** *vittatum* and *H. atlanticus* (score all < 5 cm long by family name only), Lutjanidae, Muraenidae, Pomacanthidae, Scaridae (score all < 5 cm long by family name only); Serranidae (subfam. Epinephelinae; all species of *Epinephelus*, *Cephalopholis*, *Mycteroperca*).

**LISTED Western** *Diodon holocanthus*, *D. hystrix*; *Bodianus rufus*, *Lachnolaimus maximus*, *Halichoeres*  
**Caribbean Species:** *bivittatus*, *H. garnoti*, *H. radiatus*; *Aluterus scriptus*, *Cantherhines macrocerus*, *C. pullus*; *Calamus bajonado*, *C. calamus*, *C. penna*, *C. pennatula*.

**Other Species:** *Caranx ruber*, *Kyphosus* spp. (*K. spectator* &/or *K. incisor*), *Lactophrys bicaudalis*, *Microspathodon chrysurus*, *Stegastes planifrons* *Sphoeroides spengleri*, *Sphyaena barracuda*, *Trachinotus falcatus*, *Pterois* spp. (*P. miles* &/or *P. voltans*).

**Complete at the end of each transect. Transect Information**

Stop the fish census when you reach the end of the tape. Record the following:

**End Depth:** Depth at the end of the transect; enter beside appropriate unit (ft or m).  
**Transect Comments:** Add any other important or interesting observations about the transect (e.g., the names of any conspicuously diseased fishes; fishes with external isopod or copepod parasites).

**Complete for each transect while rewinding the tape. Maximum Relief Information**

**Max. Relief.** Unhook the tape reel from the D-ring or clip and hold it while rewinding. As this requires the use of both hands, crook the elbows to rest the horizontal crosspiece of the T-bar. Pause to use the T-bar as a graduated meter stick to measure maximum relief as defined below at each of the following points along the tape: 30 m, 25 m, 20 m, 15 m, 10 m and 5 m or 90 ft, 75 ft, 60 ft, 45 ft, 30 ft and 15 ft. Be sure to put a comma or some other delimiting mark between adjacent measurements for accuracy of subsequent data entry (e.g., 170, 45, 210, 70, 150, 25).

**Max. Relief:** Vertical height in cm (not in meters) of the tallest coral or reef rock above the lowest point in the underlying substratum within a 1-m radius of each point.

Try to measure Max. Relief to the nearest 5 cm if < 50 cm, and to the nearest 10 cm if between 50 and about 400 cm high. Although depth gauges are unreliable over small changes of depth, they may be used to approximate vertical heights greater than approximately 3 m/10 ft providing the numbers are converted to cm before subsequent data entry.

Then continue to the next transect, while trying to stay **at least** 5 m laterally away from your previous position and the other divers.

**Fish teams should survey a total of 10 transects/site; more are acceptable.** To economize on the use of UW datasheets, one surveyor can be responsible for 4 transects (which requires using both sides of one UW datasheet) and is then encouraged to conduct a reef fish species richness survey (see **AGRRA OPTIONAL COMPONENTS VERSION 5.5**) while the second conducts 6 transect surveys (which requires 1.5 UW datasheets).

***Complete by the end of the dive.***

**Site Comments:**

Add any other notes about the site (*e.g.*, the maximum number of sharks of any given species seen at any one time during the dive). Describe how latitude and longitude were calculated if estimated from some fixed position.

***Complete after the dive.***

**Data Entry & Backup**

Enter all your data, including any comments, on a daily basis in a copy of the **Detailed FISH-Data Entry-V5.5** spreadsheet. Include any species that was identified after the dive on the basis of its UW sketch or description. Remember to convert any Max. Relief measurements made in meters or feet to cm.

**Use a separate copy of the spreadsheet for each site. Always back up your own data on a daily basis and store the files in a safe place.**

**For detailed instructions, see AGRRA EQUIPMENT.PPT and AGRRA FISH PROTOCOLS VERSION 5.5.pdf.**