

CATAMI classification scheme for scoring marine biota and substrata in underwater imagery

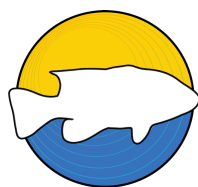
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Contributors

Nicole Hill (UTas / IMAS), Franzis Althaus (CSIRO), Tony Rees (CSIRO), Alan Jordan (Dept. of Primary Industries - NSW), Jamie Colquhoun (AIMS), Christine Schönberg (AIMS), Mark Case (AIMS), Fiona Scott (UTas), Graham Edgar (UTas), Renata Ferrari Legorreta (Uni of Sydney), Jane Fromont (WA Museum), Rachel Przeslawski (GA), Keith Hayes (CSIRO - NERP), Ziggy Marzinelli (SIMS), Ariell Friedman (Uni of Sydney), Lachlan Toohey (Uni of Sydney), Ty Hibberd (AAD), Renae Hovey / Gary Kendrick (UWA), Mathew Wyatt (ANDS)

Editor

Luke Edwards (Pawsey Supercomputing Centre)



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1. Introduction

Transforming raw underwater imagery into quantitative information useful for science and policy decisions requires substantial manual effort by human experts. This process will soon become unsustainable as the volume of imagery being collected continues to increase due to technological advances in the acquisition and resolution of imagery. Currently there is a lack of standardised approaches to the methodology, annotation, classification and analysis of this imagery. This makes comparison across disparate sites as well as further analysis very difficult. The CATAMI (Collaborative and Annotation Tools for Analysis of Marine Imagery and video) project aims to help solve some of these issues by working with the [NERP Marine Biodiversity Hub - Theme 1](#) and the marine community to develop a standard classification scheme for scoring marine biota and physical characteristics from underwater imagery.

There is a growing consensus between organisations that collect underwater imagery that greater collaboration is key to ensuring optimal utility from this data. A standardised classification scheme will assist the whole marine community by enabling aggregation, annotation and automated processing of imagery thereby saving resources and maximising the use of the limited number of taxonomic staff.

This document will outline the background to this classification and how it will be implemented to ensure researchers make best use of the great variety of imagery from Baited Remote Underwater Video (BRUV), Autonomous Underwater Vehicles (AUV), Towed Video / Imagery (TV/TI), Diver Operated Video (DOV) and Photo Quadrats.

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2. Background

2.1 Ideal characteristics of a marine habitat classification scheme

In a review of habitat classifications, Ball et al. (2006) identified the following characteristics of successful classification schemes:

- *The scheme should be hierarchical (to avoid duplication of categories)*
- *Classes should be mutually exclusive and exhaustive at each level in the hierarchy (so that each habitat type is accounted for and unique)*
- *The scheme should be comprehensive (at least at the upper levels of the scheme)*
- *The scheme should provide a common and easily-understood language for descriptions*
- *All sensing techniques should result in the same classifications, though the level to which a habitat can be classified will be dependent on the resolution of the sensor*
- *Habitat variables that change slowly (e.g. substrate) should be placed higher in the scheme than those that change rapidly (e.g. biota)*
- *Classes should be sufficiently fine to be of practical use for local managers,*

but also be sufficiently broad (through the hierarchy) as to allow summary information to be presented at national or international scales or to nonspecialists

- *The scheme should be flexible enough that it can be modified when new information is presented, but also be stable enough that it can support ongoing use. Changes should be clearly documented and related back to earlier categories.*

The classification outlined in this document matches these characteristics. Details on previous work and the basis for developing this classification are outlined below.

2.2 Previous work

It is acknowledged that there has been a great deal of work by many different organisations and individuals in developing classification schemes. Where possible we have sought to reuse and learn from these efforts while following characteristics outlined in Ball et. al. (2006). Mount et. al. (2007) provides an overview of national and state-based approaches and our classification shares many similarities such as the hierarchical structure. The hierarchical structure permits researchers the flexibility to go into as much detail as desired for project-specific purposes but allows for 'higher' level comparison of data across Australia.

Relevant (but not exhaustive) past studies / reviews:

Ball, D., Blake, S. and Plummer, A. (2006). Review of Marine Habitat Classification Systems. Parks Victoria Technical Series No. 26. Parks Victoria, Melbourne.
(http://parkweb.vic.gov.au/_data/assets/pdf_file/0003/314463/19_1855.pdf)

David W. Conner, James H. Allen, Neil Golding, Kerry L. Howell, Louise M. Lieberknecht Kate O. Northen and Johnny B. Reker. (2004). The Marine Habitat Classification for Britain and Ireland Version 04.05 JNCC, Peterborough. ISBN 1 861 07561 8 (internet version)
jncc.defra.gov.uk/MarineHabitatClassification

Diaz, R. J., M. Solan and R. Valente (2004). "A review of approaches for classifying benthic habitats and evaluating habitat quality." *Journal of Environmental Management* (73): 165-181.
(<http://dx.doi.org/10.1016/j.jenvman.2004.06.004>)

Greene, H.Gary , Mary M Yoklavich, Richard M Starr, Victoria M O'Connell, W.Waldo Wakefield, Deidre E Sullivan, James E McRea Jr., Gregor M Cailliet, A classification scheme for deep seafloor habitats, *Oceanologica Acta*, Volume 22, Issue 6, November–December 1999, Pages 663-678, ISSN 0399-1784, ([http://dx.doi.org/10.1016/S0399-1784\(00\)88957-4](http://dx.doi.org/10.1016/S0399-1784(00)88957-4))

Joint Nature Conservation Committee (JNCC). Edited by Jon Davies (senior editor), John Baxter, Martin Bradley, David Connor, Janet Khan, Eleanor Murray, William Sanderson, Caroline Turnbull and Malcolm Vincent. UK Marine Monitoring Handbook (2001)
http://jncc.defra.gov.uk/PDF/MMH-mmh_0601.pdf

Mount, R., Bricher, P. and Newton, J. (2007). National Intertidal/Subtidal Benthic

(NISB) Habitat Classification Scheme. Australian Greenhouse Office; National Land & Water Resources Audit; School of Geography and Environmental Studies, University of Tasmania (<http://lwa.gov.au/files/products/national-land-and-water-resources-audit/pn21267/pn21267.pdf>)

2.3 Why not use an existing classification?

There are a variety of reasons why CATAMI has decided to create a more relevant classification. The reasons for not using an existing classification include:

- a) Too detailed
- b) Not detailed enough
- c) Not appropriate for video / imagery 'within image' scoring and analysis
- d) Lacking taxonomy / morphology characteristics suited to imagery

An example is the Marine Habitat Classification for Britain & Ireland ([v04.05](#)) - which is part of the 'European Nature Information System' ([EUNIS](#)) habitat classification. Even though this is hierarchical in nature it wouldn't be feasible to implement as they are defining 'habitats'; most likely from an entire frame or section of imagery / video. We wish to capture and identify biota at points within an image and at a whole image level.

The conceptual basis for this classification was to create a taxonomy-based system that includes morphological categories to take into account the fact that it is not always possible to identify biota to species or genus level from imagery. For example, some taxa such as sponges can only be classified to a broad morphology rather than a taxonomic group from imagery alone. The classification also needed to be simple and easy to implement across all collection methods and tools, geographic extents (e.g. tropical, temperate, shallow, deep) and sampling resolutions.

Finally we wanted to ensure it was sustainable. The classification is mostly taxonomy based so it could be easily incorporated into the existing Codes for Australian Aquatic Biota ([CAAB](#)). This has advantages which will be outlined in section 4.

2.4 Previous versions - changes

Versions 1.0 - 1.1 contained various iterations that were updated through 2012 and early 2013. At the AMSA 2012 conference it was discussed and in October 2012 a draft was circulated. Version 1.0 was released in late February 2013 and Version 1.1 was released in April 2013.

Version 1.2 was released in August 2013, this was the first version to be documented in a pictorial guide. The classification was a product of several workshops and extensive discussions among scientists interested in scoring marine underwater imagery. The classification was also presented and discussed at AMSA 2013. There were changes to coral, physical categories, seagrasses, worms from Version 1.1.

Version 1.3 released in December 2013. This version contains two changes from V1.2:

- (1) An update in the hierarchical structure of the **Sponges- CAAB 10 000000** which reflects the updated 'Cheat Sheet' of functional sponge morphologies finalised by Schönberg & Fromont 2013 after the 9th World Sponge Conference 2013, Fremantle (<http://www.spongeconference2013.org/home>). For details see Table below.
- (2) Addition of a sub-division (i.e. additional branches in the tree) in the Macroalgae: **Encrusting: Red – CAAB 80 300929** category – two sub-categories. For details see Table below.

Version 1.4 released in December 2014. This version contains the following changes from V1.3:

- (1) Update of NERP Marine Biodiversity Hub logo on front page
- (2) Correction of classification for example image pg 70 'Unstalked solitary ascidian with elongate siphons' was removed as incorrect identification – image moved to pg 59 Ctenophora (benthic) Lyrocteis sp. —with thanks to D. Lindsey (JAMSTEC) for the correction.
- (3) Updated publication reference for Gershwin et al. in prep, now Gershwin et al. 2014
- (4) Update of sponge classifications and publication reference now Schönberg & Fromont 2014; incorporated sponge classification example images into the CATAMI visual guide.
- (5) The Visual guide V1.4 (Althaus et al 2013) includes these changes and in addition new/updated references and one correction of a misidentified image

Version 1.1 → 1.2

| CATAMI CAAB CODE | CATAMI DISPLAY NAME | CATAMI CAAB PARENT CODE | CHANGE |
|------------------|---|-------------------------|--|
| 20 000908 | Bryozoa: Hard: Branching | 20 000901 | New category |
| 11 171000 | Cnidaria: Corals: Black & Octocorals: Blue coral (Heliopora) | 11 168901 | New category |
| 11 168920 | Cnidaria: Corals: Black & Octocorals: Massive soft corals | 11 168901 | New category |
| 11 201901 | Cnidaria: Corals: Black & Octocorals: Organ pipe coral (Tubipora) | 11 168901 | New category |
| 11 290907 | Cnidaria: Corals: Stony corals: Foliose / plate | 11 290000 | 11290914 - Cnidaria: Corals: Stony corals: Lattice-forming - deleted (include in 11290912) |
| 11 290901 | Cnidaria: Corals: Stony corals: Solitary | 11 290000 | Changed name (was: Cnidaria: Corals: Stony corals: Solitary / Mushroom) |
| 11 290903 | Cnidaria: Corals: Stony corals: Solitary: Attached | 11 290901 | Changed name (was: Cnidaria: Corals: Stony corals: Solitary / Mushroom: Attached) |

| | | | |
|-----------|--|-----------|--|
| 11 290902 | Cnidaria: Corals: Stony corals: Solitary: Free-living | 11 290901 | Changed name (was: Cnidaria: Corals: Stony corals: Solitary / Mushroom: Free-living) |
| 11 298000 | Cnidaria: Corals: Stony corals: Solitary: Mushroom (Fungiidae) | 11 290901 | New category |
| 11 077906 | Cnidaria: Hydrocorals: Branching | 11 077000 | New category |
| 11 077907 | Cnidaria: Hydrocorals: Submassive / encrusting | 11 077000 | New category |
| 28 836000 | Crustacea: Crabs: King crabs | 28 000903 | New category |
| 28 825903 | Crustacea: Hermit crabs: With anemones | 28 825901 | Name change |
| 28 825902 | Crustacea: Hermit crabs: With shell or stone home | 28 825901 | Name change |
| 23 607000 | Molluscs: Cephalopods: Cuttlefish | 23 590000 | New category |
| 82 003007 | Relief: High: Wall | 82 003005 | Changed name (was: Relief: High: Rock wall) |
| 63 600902 | Seagrasses: Elliptical leaves | 80 000901 | New category |
| 63 600903 | Seagrasses: Strap-like leaves | 80 000901 | New category |
| 82 001018 | Substrate: Unconsolidated (soft): Pebble / gravel: Biogenic: Rhodoliths | 82 001007 | New category |
| 82 001017 | Substrate: Unconsolidated (soft): Pebble / gravel: Biogenic: Screwshells | 82 001007 | New category |
| 80 600901 | Worms | 80 000000 | 80600902 (Worms: Echiura / Sipuncula) deleted - go straight to 17020000 and 17000000 |
| 17 020000 | Worms: Echiura | 80 600901 | Name, parent ID changed (was Worms: Echiura / Sipuncula: Echiura) |
| 17 000000 | Worms: Sipuncula | 80 600901 | Name, parent ID changed (was Worms: Echiura / Sipuncula: Sipuncula) |

Version 1.2 → 1.3

| CATAMI CAAB CODE | CATAMI DISPLAY NAME | CATAMI CAAB PARENT CODE | CHANGE |
|------------------|---|-------------------------|---|
| 10 000917 | Sponges: Crusts: Creeping / ramose | 10 000901 | New category |
| 10 000906 | Sponges: Erect forms: Stalked | 10 000912 | Changed name (10000906 - Sponges: Massive forms: Stalked - Deleted and placed here) |
| 10 000919 | Sponges: Hollow forms: Cups and alike: Cup / goblet | 10 000910 | New category |

| | | | |
|-----------|---|-----------|---|
| 10 000918 | Sponges: Hollow forms: Cups and alikes: Incomplete cup / curled fan | 10 000910 | New category |
| 10 000920 | Sponges: Hollow forms: Tabular | 10 000909 | New category |
| 10 000905 | Sponges: Massive forms: Balls | 10 000903 | Changed name (was Sponges: Massive forms: Radially organised) |
| 80 300934 | Macroalgae: Encrusting: Red: Calcareous | 80 300929 | New category |
| 80 300935 | Macroalgae: Encrusting: Red: Non-calcareous | 80 300929 | New category |

Version 1.3 → 1.4

| CATAMI CAAB CODE | CATAMI DISPLAY NAME | CATAMI CAAB PARENT CODE | CHANGE |
|------------------|---|-------------------------|--|
| 10 000901 | Sponges: Crusts: Endolithic / bioeroding | 10 000921 | New category |
| 10 000909 | Sponges: Cup-likes | 10 000000 | Changed name: was 'Hollow forms' |
| 10 000910 | Sponges: Cup-likes: Cups | 10 000909 | Parent name updated & Changed name: was 'Cups and alikes' |
| 10 000920 | Sponges: Cup-likes: Cups: Tables / discs | 10 000910 | Moved is now subcategory under 10000910, changed name: was 'Tabular' |
| 10 000919 | Sponges: Cup-likes: Cups: Cup / goblet | 10 000910 | Parent name updated |
| 10 000918 | Sponges: Cup-likes: Cups: Incomplete cup / curled fan | 10 000910 | Parent name updated |
| 10 000907 | Sponges: Cup-likes: Barrels | 10 000909 | Parent name updated |
| 10 000911 | Sponges: Cup-likes: Tubes and chimneys | 10 000909 | Parent name updated |

3. CATAMI classification scheme

The classification scheme was designed to allow images from shallow waters to abyssal depths and from the tropics to Antarctic waters to be classified using the same labels, i.e. a set of consistent identifiers. Each standardised label was also assigned a CAAB 'code'. CAAB stands for Codes for Australian Aquatic Biota and is a numerical code that is listed, described and maintained through a CSIRO website at (<http://www.cmar.csiro.au/caab/>).

Additional codes were necessary to indicate where a point/ image was not considered by the scorer (might have been missed or simply not yet labelled), is unscorable because of e.g. lighting issues or image quality, was not of interest to the current scorer (i.e. deliberately not considered) or had no visible biota. For data-basing purposes these scores needed a numeric, 8-digit code mimicking the published CAAB. In the CATAMI database the following codes are used:

Not considered

CAAB 00 000000

Unscorable
 Not of interest
 No visible biota

CAAB 00 000001
 CAAB 00 000002
 CAAB 00 000003

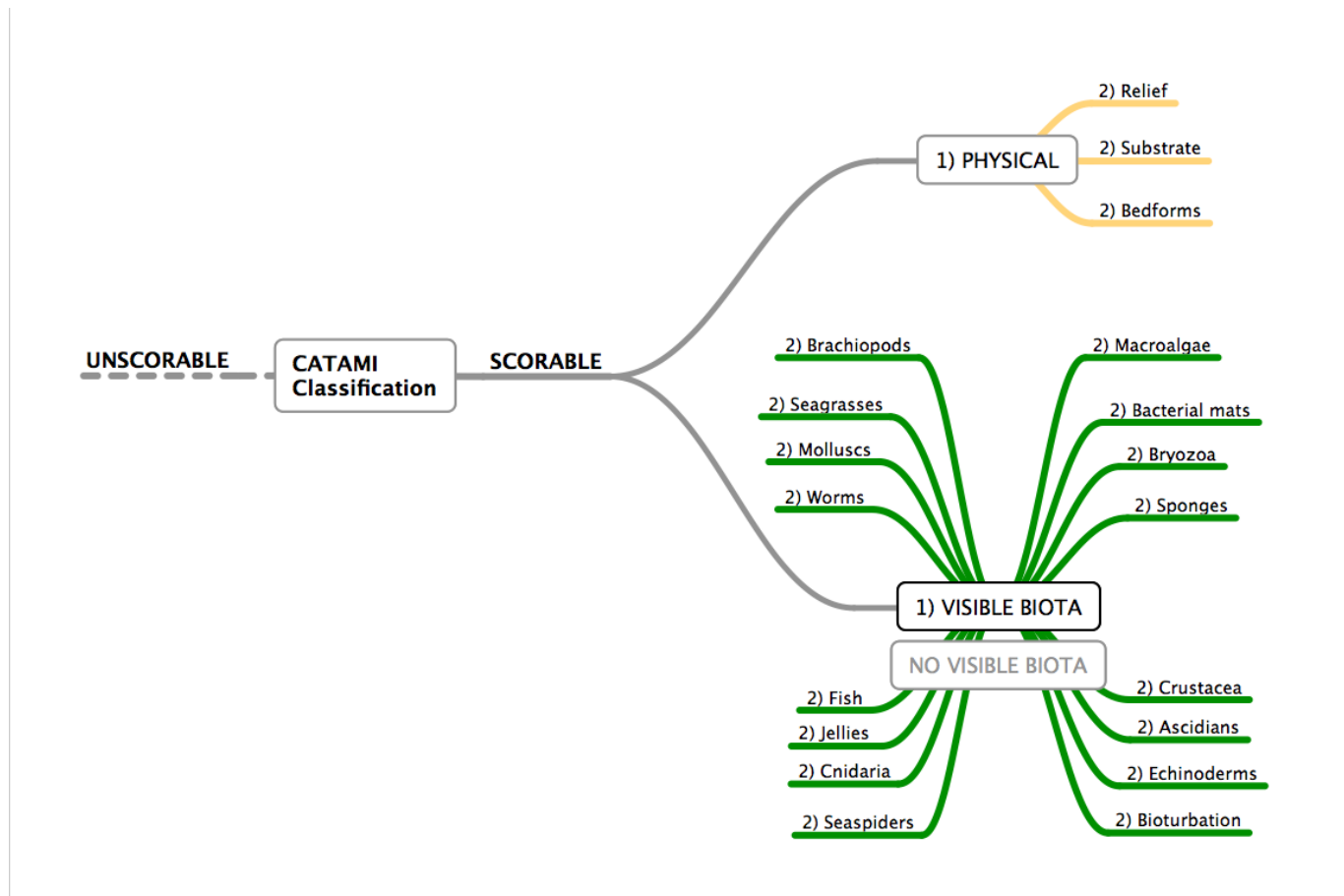


Figure 1: High level overview of the CATAMI classification scheme. Numbers indicate 1st level of hierarchy (1) or second (2). To view lower levels of the hierarchy refer to Appendix A and Figure 2.

3.1 Visible Biota

In images only visible biota (epiflora and epifauna) or visible traces of biota (bioturbation) can be reliably detected, thus the presence / absence of visible biota is at the highest level of the hierarchy. The second level of the hierarchy is mostly based on phylogeny, with Bioturbation, Bacterial mats, 'Jellies' and 'Worms' forming the obvious exceptions. 'Jellies' is a catch-all grouping of gelatinous fauna including siphonophores, jellyfish, saps, etc.; 'Worms' refer to worm-like fauna, including several groups such as peanut-, spoon-, segmented-, flat-, acorn- and penis worms. As mentioned above the taxonomic classification within some taxa relies on fine-scale details that cannot easily be distinguished in imagery. For those taxa - Macroalgae, Sponges, Bryozoa, Cnidaria and Ascidians - the classification is based on morphological characteristics. For a detailed list of the entire classification refer to Appendix A or the ['explodagram'](#)

3.2 Physical (Substrata)

The physical appearance of the seabed can be described based on the appearance of the substrata and based on the structure of the seabed (bedform and relief), using the

classification outlined below (Figure 2 / Table 1). Note that the 'Relief' category would be superseded by more detailed information such as multibeam acquisition and may only be useful to imagery obtained without this. In addition, wave height (> 10 cm) applies only to this image classification scheme and should not be used in other capacities. Note that from a geological perspective, waves are generally considered far larger but are confined here to anything >10 cm due to the comparatively small field of view of most underwater imaging systems.

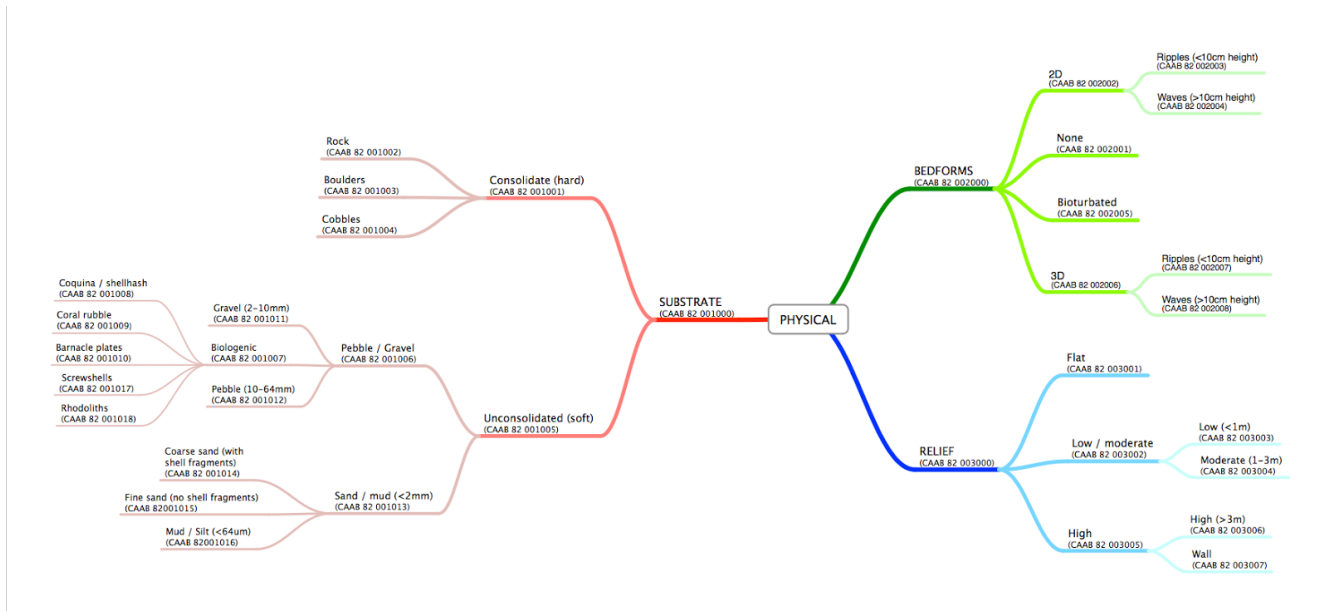


Figure 2: CATAMI Physical Classification showing all hierarchy levels.

| CATAMI CAAB CODE | CATAMI DISPLAY NAME | CATAMI CAAB PARENT CODE | CPCe CODE |
|------------------|--------------------------------------|-------------------------|-----------|
| 82 002000 | Bedforms | 82 000000 | B |
| 82 002002 | Bedforms: 2D | 82 002000 | B2 |
| 82 002003 | Bedforms: 2D: Ripples (<10cm height) | 82 002002 | B2R |
| 82 002004 | Bedforms: 2D: Waves (>10cm height) | 82 002002 | B2W |
| 82 002006 | Bedforms: 3D | 82 002000 | B3 |
| 82 002007 | Bedforms: 3D: Ripples (<10cm height) | 82 002006 | B3R |
| 82 002008 | Bedforms: 3D: Waves (>10cm height) | 82 002006 | B3W |
| 82 002005 | Bedforms: Bioturbated | 82 002000 | BB |
| 82 002001 | Bedforms: None | 82 002000 | BN |
| 82 000000 | Physical | | |
| 82 003000 | Relief | 82 000000 | R |
| 82 003001 | Relief: Flat | 82 003000 | RF |
| 82 003005 | Relief: High | 82 003000 | RH |
| 82 003006 | Relief: High: High (>3m) | 82 003005 | RHH |

| | | | |
|-----------|--|-----------|-------|
| 82 003007 | Relief: High: Wall | 82 003005 | RHR |
| 82 003002 | Relief: Low / moderate | 82 003000 | RL |
| 82 003003 | Relief: Low / moderate: Low (<1m) | 82 003002 | RLL |
| 82 003004 | Relief: Low / moderate: Moderate (1-3m) | 82 003002 | RLM |
| 82 001000 | Substrate | 82 000000 | S |
| 82 001001 | Substrate: Consolidated (hard) | 82 001000 | SC |
| 82 001003 | Substrate: Consolidated (hard): Boulders | 82 001001 | SCB |
| 82 001004 | Substrate: Consolidated (hard): Cobbles | 82 001001 | SCC |
| 82 001002 | Substrate: Consolidated (hard): Rock | 82 001001 | SCR |
| 82 001005 | Substrate: Unconsolidated (soft) | 82 001000 | SU |
| 82 001006 | Substrate: Unconsolidated (soft): Pebble / gravel | 82 001005 | SUP |
| 82 001007 | Substrate: Unconsolidated (soft): Pebble / gravel: Biogenic | 82 001006 | SUPB |
| 82 001010 | Substrate: Unconsolidated (soft): Pebble / gravel: Biogenic: Barnacle plates | 82 001007 | SUPBB |
| 82 001008 | Substrate: Unconsolidated (soft): Pebble / gravel: Biogenic: Coquina / shellhash | 82 001007 | SUPBC |
| 82 001009 | Substrate: Unconsolidated (soft): Pebble / gravel: Biogenic: Coral rubble | 82 001007 | SUPBR |
| 82 001018 | Substrate: Unconsolidated (soft): Pebble / gravel: Biogenic: Rhodoliths | 82 001007 | SUPBR |
| 82 001017 | Substrate: Unconsolidated (soft): Pebble / gravel: Biogenic: Screwshells | 82 001007 | SUPBS |
| 82 001011 | Substrate: Unconsolidated (soft): Pebble / gravel: Gravel (2-10mm) | 82 001006 | SUPG |
| 82 001012 | Substrate: Unconsolidated (soft): Pebble / gravel: Pebble (10-64mm) | 82 001006 | SUPP |
| 82 001013 | Substrate: Unconsolidated (soft): Sand / mud (<2mm) | 82 001005 | SUS |
| 82 001014 | Substrate: Unconsolidated (soft): Sand / mud (<2mm): Coarse sand (with shell fragments) | 82 001013 | SUSC |
| 82 001015 | Substrate: Unconsolidated (soft): Sand / mud (<2mm): Fine sand (no shell fragments) | 82 001013 | SUSF |
| 82 001016 | Substrate: Unconsolidated (soft): Sand / mud (<2mm): Mud / silt (<64um) | 82 001013 | SUSM |

Table 1: List of CAAB codes assigned to CATAMI Physical Classification

3.3 Qualifiers

Below are a list of "qualifiers" for the CATAMI standardised classifications. These are standardised descriptors of biota or physical characters that provide useful additional information for later analyses and comparisons by researchers. This is a controlled list, in

order to facilitate database searches, which can be amended if appropriate. For most up-to-date list visit: <https://github.com/catami/catami/wiki/Qualifiers>

Natural

- 'Bleached'
- 'Dead'
- 'Storm damage'
- 'Urchin barren'
- 'Iceberg scour'
- 'Veneer'
- 'Epiphyte'
- 'Rhodolith' (*for algae -> crustose / prostrate -> red*)
- 'Recruits'

Anthropogenic

- 'Rubbish - Concentrated' (*e.g. dumpsite*)
- 'Rubbish - Occasional' (*e.g. car tyre*)
- 'Rubbish - Shipwreck'
- 'Fishery related - Gear tracks / marks'
- 'Fishery related - Damage to solid epifauna',
- 'Fishery related - Discarded / lost gear'

Level (default is primary)

- 'Primary' = organism on the seafloor (e.g. urchin on sand)
- 'Secondary' = raised above the seabed and obstructing view of the understory (e.g. algae frond).
- 'Tertiary' = sitting on a primary or secondary organisms (i.e. urchin on an algae frond)

Whole-image classification

Using the CATAMI classification, researchers can classify the image 'as a whole' according to *dominant* biota and/or *dominant* substrata / bedform / relief. Where biota is sparse, the *dominant* biota may not cover much of the image; thus, a qualifier can be added to indicate the percentage of the field of view (FOV) covered by the dominant biota. This scale was deliberately chosen to keep things manageable, other schemes such as [SACFOR](#) scale relate to 'finer / detailed' scoring which can be accomplished using the CATAMI classification scheme labels via a number of different methodologies (e.g. random point counts in CPCe or CATAMI online annotation tool).

- '<20% FOV'
- '20-40% FOV'
- '40-60% FOV'
- '60-80% FOV'
- '>80% FOV'

For example

- *Visible Biota | Sponges (Porifera) | Massive | >80%*
- *Visible Biota | Cnidaria | Coral | Stony Coral*
- *Visible Biota | Cnidaria | Coral | Stony Coral (Bleached)*

- *Visible Biota | Cnidaria | Coral | Stony Coral (Dead)*
- *Physical | Consolidate (hard) | Rock*
- *Physical | Consolidate (hard) | Rock (Occasional)*
- *Physical | Consolidate (hard) | Boulders (Urchin barren)*
- *Physical | Unconsolidated (soft) | Sand (Veneer)*

3.4 Methodology / Tools

In addition to having labels for biota and physical characteristics it is important to consider the tools used to collect imagery and the methods used to score them. The development of tools for image acquisition in marine environments is a very active area and it would be short-sighted to try and be prescriptive about how imagery is collected. Similarly methods for annotating and scoring images tend to reflect the research question being addressed and potential limitations of the collection method, and thus are tailored in the approach (random point counts, densities, overview) and level of detail (e.g. species identification but only of macroalgae, or phylum-level identification of everything), rather than follow an overarching set-out protocol. Although separate to the classification, this information is important if researchers wish to incorporate scored data into CATAMI to be potentially used by other researchers.

When creating a “campaign” in CATAMI, users are asked to provide “publications”, this is a suitable location to provide links to papers / reports which detail methodology in greater detail. In addition, collection or scoring method (with standardised high-level categories) should be filled in to facilitate database searching and selection based on methods. Having high level methodology categories are useful for aggregating data into CATAMI. This will assist in comparison along with the specific methodology used. Having this information in the CATAMI database will be useful to flag future comparison and analysis of data.

High level methodology categories

1. Point Counts (e.g. CPCe - Coral Point Count)
2. Relative abundance
3. Quadrats (e.g. Williams et al., 2010; Rowden et al., 2010)
4. Point of change (e.g. Williams et al., 2009; Althaus et al., 2009)
5. Real-time fixed window (e.g. Anderson et. al. 2007)

High-level collection tool categories

1. BRUV (Baited Remote Underwater Video) / (SISSTAs) Stereo Imagery System for Shark and Tuna Analysis
2. AUV (Autonomous Underwater Vehicle)
3. Towed / tethered system
4. Diver based (e.g. DOV - Diver Operated Video / Photo quadrats)
5. ROV (Remote Operated Vehicle)
6. Manned vehicle

Qualifiers for the 6 high-level collection tool categories are:

- **View angle** [planar (vertical / downward) or slanting (oblique) or seascape (horizontal)]
- **Camera set-up** [stereo or mono]; [if stereo calibrated or not]
- **Image type** [still images, mosaic (e.g. AUV), HD video stream, PAL]
- **Precision of location** [how camera position is derived (USBL beacon, triangulation, ship location)]

4. Implementation

When developing this classification it was identified early on that there needed to be an easy method for researchers to use and incorporate into their workflows. Listed below are methods for interacting with this classification. A guide to the classification has also been developed which will contain example photos and descriptions for the entire classification scheme (Althaus et al. 2013). Please refer to the following [wiki](#) for the most up-to-date information. The [CAAB](#) website will also contain this information to aid researchers in scoring imagery.

a) Integration with CAAB

[CAAB](#) is a managed and expanding 8-digit coding system for aquatic organisms in the Australian region maintained by CSIRO Division of Marine and Atmospheric Research, Australia (CMAR). CAAB are being expanded to incorporate the CATAMI classification morphology types. This will aid implementation as many researchers are already familiar and use CAAB through their existing workflows. This also assists in sustainability as the 'point of truth' database will reside at CSIRO which is an established organisation rather than a project. Having this security will provide researchers with a level of confidence to use the classification.

b) Cross-walk existing classifications

When developing the classification it was acknowledged that for a variety of reasons organisations would not be able to switch to the CATAMI classification, at least initially. The CATAMI team will work with relevant organisations who wish to share their data to ensure their 'in-house' classifications map correctly to the CATAMI classification and will provide standard templates to import data. An example is the creation of a CATAMI-CPC code file so researchers using the CPC software to annotate images can use the CATAMI classification scheme and then import into CATAMI. To assist researchers CPC codes are given in this document, further information is available from Kohler and Gill (2006).

c) CATAMI online interface

Researchers will be able to score and browse using this classification via the CATAMI online interface as it becomes fully functional (<http://catami.org>).

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[df\)](#)

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Appendix A: CATAMI Biota CAAB codes

| CATAMI | CATAMI DISPLAY NAME | CATAMI CAAB | CPC |
|--------|---------------------|-------------|-----|
|--------|---------------------|-------------|-----|

| CAAB CODE | | PARENT CODE | CODE |
|-----------|--|-------------|--------------|
| 35 000000 | Ascidians | 80 000000 | A |
| 35 000904 | Ascidians: Stalked | 35 000000 | AS |
| 35 000906 | Ascidians: Stalked: Colonial | 35 000904 | ASC |
| 35 000905 | Ascidians: Stalked: Solitary | 35 000904 | ASS |
| 35 000901 | Ascidians: Unstalked | 35 000000 | AU |
| 35 000903 | Ascidians: Unstalked: Colonial | 35 000901 | AUC |
| 35 000902 | Ascidians: Unstalked: Solitary | 35 000901 | AUS |
| 72 000901 | Bacterial mats | 80 000000 | BM |
| 70 000901 | Bacterial mats: Cyanobacteria | 72 000901 | BMC |
| 72 000902 | Bacterial mats: Other | 72 000901 | BMO |
| 80 000000 | Biota | | BIOTA |
| 81 000000 | Bioturbation | 80 000000 | BI |
| 81 005000 | Bioturbation: Crawling traces | 81 000000 | BIC |
| 81 005003 | Bioturbation: Crawling traces: Complex trail | 81 005000 | BICCT |
| 81 005006 | Bioturbation: Crawling traces: Crater row | 81 005000 | BICCR |
| 81 005007 | Bioturbation: Crawling traces: Disturbed trace | 81 005000 | BICD |
| 81 005004 | Bioturbation: Crawling traces: Mounded trail | 81 005000 | BICM |
| 81 005005 | Bioturbation: Crawling traces: Perforated trail | 81 005000 | BICP |
| 81 005002 | Bioturbation: Crawling traces: Thick trail | 81 005000 | BICTK |
| 81 005001 | Bioturbation: Crawling traces: Thin trail | 81 005000 | BICTN |
| 81 001000 | Bioturbation: Dwelling traces | 81 000000 | BID |
| 81 001004 | Bioturbation: Dwelling traces: Burrow cluster | 81 001000 | BIDB |
| 81 001012 | Bioturbation: Dwelling traces: Crater cone | 81 001000 | BIDC |
| 81 001001 | Bioturbation: Dwelling traces: Elongate depression | 81 001000 | BIDE |
| 81 001013 | Bioturbation: Dwelling traces: Fractured mound | 81 001000 | BIDF |
| 81 001002 | Bioturbation: Dwelling traces: Large mound | 81 001000 | BIDL |
| 81 001005 | Bioturbation: Dwelling traces: Oblique burrow | 81 001000 | BIDO |
| 81 001007 | Bioturbation: Dwelling traces: Paired burrow | 81 001000 | BIDP |
| 81 001010 | Bioturbation: Dwelling traces: Rounded crater ring | 81 001000 | BIDR |
| 81 001006 | Bioturbation: Dwelling traces: Single burrow | 81 001000 | BIDSB |
| 81 001003 | Bioturbation: Dwelling traces: Small mound | 81 001000 | BIDSM |
| 81 001011 | Bioturbation: Dwelling traces: Spiked crater ring | 81 001000 | BIDSC |

| | | | |
|-----------|---|-----------|-------|
| 81 001014 | Bioturbation: Dwelling traces: Spotted mound | 81 001000 | BIDSP |
| 81 001009 | Bioturbation: Dwelling traces: Trapdoor burrow | 81 001000 | BIDT |
| 81 001008 | Bioturbation: Dwelling traces: Vertical burrow | 81 001000 | BIDV |
| 81 004000 | Bioturbation: Feeding traces | 81 000000 | BIF |
| 81 004001 | Bioturbation: Feeding traces: Large rosette | 81 004000 | BIFL |
| 81 004003 | Bioturbation: Feeding traces: Petal rosette | 81 004000 | BIFPE |
| 81 004005 | Bioturbation: Feeding traces: Pincushion rosette | 81 004000 | BIFPI |
| 81 004004 | Bioturbation: Feeding traces: Rayed mound | 81 004000 | BIFR |
| 81 004002 | Bioturbation: Feeding traces: Small rosette | 81 004000 | BIFS |
| 81 006000 | Bioturbation: Organism tests | 81 000000 | BIO |
| 81 006002 | Bioturbation: Organism tests: Globule xenophyophore | 81 006000 | BIOG |
| 81 006001 | Bioturbation: Organism tests: Lumpy xenophyophore | 81 006000 | BIOL |
| 81 003000 | Bioturbation: Resting traces | 81 000000 | BIR |
| 81 003003 | Bioturbation: Resting traces: Large depression | 81 003000 | BIRL |
| 81 003002 | Bioturbation: Resting traces: Star impression | 81 003000 | BIRS |
| 81 003001 | Bioturbation: Resting traces: Urchin trace | 81 003000 | BIRU |
| 81 007000 | Bioturbation: Unknown origin | 81 000000 | BIU |
| 81 007006 | Bioturbation: Unknown origin: Fern | 81 007000 | BIUF |
| 81 007005 | Bioturbation: Unknown origin: Matchstick | 81 007000 | BIUMA |
| 81 007003 | Bioturbation: Unknown origin: Mesh | 81 007000 | BIUME |
| 81 007001 | Bioturbation: Unknown origin: Ovoid pinnate | 81 007000 | BIUO |
| 81 007007 | Bioturbation: Unknown origin: Pogostick | 81 007000 | BIUP |
| 81 007002 | Bioturbation: Unknown origin: Round pinnate | 81 007000 | BIUR |
| 81 007004 | Bioturbation: Unknown origin: Spider | 81 007000 | BIUS |
| 81 002000 | Bioturbation: Waste casts | 81 000000 | BIW |
| 81 002001 | Bioturbation: Waste casts: Coiled casts | 81 002000 | BIWCO |
| 81 002005 | Bioturbation: Waste casts: Curly casts | 81 002000 | BIWCU |
| 81 002004 | Bioturbation: Waste casts: Mounded casts | 81 002000 | BIWM |
| 81 002006 | Bioturbation: Waste casts: Nest casts | 81 002000 | BIWN |
| 81 002003 | Bioturbation: Waste casts: Round casts | 81 002000 | BIWR |
| 81 002007 | Bioturbation: Waste casts: Spirals | 81 002000 | BIWSP |
| 81 002008 | Bioturbation: Waste casts: Switchbacks | 81 002000 | BIWSW |
| 81 002002 | Bioturbation: Waste casts: Wavy casts | 81 002000 | BIWW |

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|-----------|---|-----------|-------|
| 19 100000 | Brachiopods | 80 000000 | BRA |
| 20 000000 | Bryozoa | 80 000000 | BRY |
| 20 000901 | Bryozoa: Hard | 20 000000 | BRYH |
| 20 000908 | Bryozoa: Hard: Branching | 20 000901 | BRYHB |
| 20 000902 | Bryozoa: Hard: Encrusting | 20 000901 | BRYHE |
| 20 000903 | Bryozoa: Hard: Fenestrate | 20 000901 | BRYHF |
| 20 000904 | Bryozoa: Hard: Massive | 20 000901 | BRYHM |
| 20 000905 | Bryozoa: Soft | 20 000000 | BRYS |
| 20 000906 | Bryozoa: Soft: Dendroid | 20 000905 | BRYSB |
| 20 000907 | Bryozoa: Soft: Foliose | 20 000905 | BRYSF |
| 11 500000 | Cnidaria | 80 000000 | CN |
| 11 500901 | Cnidaria: Colonial anemones | 11 500000 | CNCA |
| 11 280000 | Cnidaria: Colonial anemones: Corallimorphs | 11 500901 | CNCAC |
| 11 284000 | Cnidaria: Colonial anemones: Zoanthids | 11 500901 | CNCAZ |
| 11 168000 | Cnidaria: Corals | 11 500000 | C |
| 11 168901 | Cnidaria: Corals: Black & Octocorals | 11 168000 | CB |
| 11 171000 | Cnidaria: Corals: Black & Octocorals: Blue coral (Heliopora) | 11 168901 | CBBH |
| 11 168902 | Cnidaria: Corals: Black & Octocorals: Branching (3D) | 11 168901 | CBB |
| 11 168909 | Cnidaria: Corals: Black & Octocorals: Branching (3D): Fleshy | 11 168902 | CBBF |
| 11 168911 | Cnidaria: Corals: Black & Octocorals: Branching (3D): Fleshy: Arborescent | 11 168909 | CBBFA |
| 11 168910 | Cnidaria: Corals: Black & Octocorals: Branching (3D): Fleshy: Mushroom | 11 168909 | CBBFM |
| 11 168903 | Cnidaria: Corals: Black & Octocorals: Branching (3D): Non-fleshy | 11 168902 | CBBN |
| 11 168904 | Cnidaria: Corals: Black & Octocorals: Branching (3D): Non-fleshy: Arborescent | 11 168903 | CBBNA |
| 11 168905 | Cnidaria: Corals: Black & Octocorals: Branching (3D): Non-fleshy: Bottle-brush | 11 168903 | CBNB |
| 11 168907 | Cnidaria: Corals: Black & Octocorals: Branching (3D): Non-fleshy: Bottle-brush: Complex | 11 168905 | CBNBC |
| 11 168906 | Cnidaria: Corals: Black & Octocorals: Branching (3D): Non-fleshy: Bottle-brush: Simple | 11 168905 | CBNBS |
| 11 168908 | Cnidaria: Corals: Black & Octocorals: Branching (3D): Non-fleshy: Bushy | 11 168903 | CBNBU |
| 11 168919 | Cnidaria: Corals: Black & Octocorals: Encrusting | 11 168901 | CBE |
| 11 168912 | Cnidaria: Corals: Black & Octocorals: Fan (2D) | 11 168901 | CBF |

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| 11 168913 | Cnidaria: Corals: Black & Octocorals: Fan (2D): Fern-frond | 11 168912 | CBFF |
| 11 168915 | Cnidaria: Corals: Black & Octocorals: Fan (2D): Fern-frond: Complex | 11 168913 | CBFFC |
| 11 168914 | Cnidaria: Corals: Black & Octocorals: Fan (2D): Fern-frond: Simple | 11 168913 | CBFFS |
| 11 168916 | Cnidaria: Corals: Black & Octocorals: Fan (2D): Rigid | 11 168912 | CBFR |
| 11 168920 | Cnidaria: Corals: Black & Octocorals: Massive soft corals | 11 168901 | CBM |
| 11 201901 | Cnidaria: Corals: Black & Octocorals: Organ pipe coral (Tubipora) | 11 168901 | CBOT |
| 11 168918 | Cnidaria: Corals: Black & Octocorals: Quill (seapen) | 11 168901 | CBQ |
| 11 168917 | Cnidaria: Corals: Black & Octocorals: Whip | 11 168901 | CBW |
| 11 290000 | Cnidaria: Corals: Stony corals | 11 168000 | CS |
| 11 290904 | Cnidaria: Corals: Stony corals: Bottlebrush | 11 290000 | CSBO |
| 11 290912 | Cnidaria: Corals: Stony corals: Branching | 11 290000 | CSBR |
| 11 290915 | Cnidaria: Corals: Stony corals: Columnar | 11 290000 | CSCOL |
| 11 290910 | Cnidaria: Corals: Stony corals: Corymbose | 11 290000 | CSCOR |
| 11 290909 | Cnidaria: Corals: Stony corals: Digitate | 11 290000 | CSD |
| 11 290908 | Cnidaria: Corals: Stony corals: Encrusting | 11 290000 | CSE |
| 11 290907 | Cnidaria: Corals: Stony corals: Foliose / plate | 11 290000 | CSF |
| 11 290906 | Cnidaria: Corals: Stony corals: Massive | 11 290000 | CSM |
| 11 290901 | Cnidaria: Corals: Stony corals: Solitary | 11 290000 | CSSO |
| 11 290903 | Cnidaria: Corals: Stony corals: Solitary: Attached | 11 290901 | CSSOA |
| 11 290902 | Cnidaria: Corals: Stony corals: Solitary: Free-living | 11 290901 | CSSOF |
| 11 298000 | Cnidaria: Corals: Stony corals: Solitary: Mushroom (Fungiidae) | 11 290901 | CSSOM |
| 11 290913 | Cnidaria: Corals: Stony corals: Staghorn | 11 290000 | CSST |
| 11 290905 | Cnidaria: Corals: Stony corals: Sub-massive | 11 290000 | CSSU |
| 11 290911 | Cnidaria: Corals: Stony corals: Tabulate | 11 290000 | CST |
| 11 077000 | Cnidaria: Hydrocorals | 11 500000 | CNHYC |
| 11 077906 | Cnidaria: Hydrocorals: Branching | 11 077000 | CNHYCB |
| 11 077907 | Cnidaria: Hydrocorals: Submassive / encrusting | 11 077000 | CNHYCS |
| 11 001000 | Cnidaria: Hydroids | 11 500000 | CNHYD |
| 11 229000 | Cnidaria: True anemones | 11 500000 | CNTR |
| 11 229901 | Cnidaria: True anemones: Flytrap | 11 229000 | CNTFT |

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| 11 229902 | Cnidaria: True anemones: Fourlobed | 11 229000 | CNTFL |
| 11 229903 | Cnidaria: True anemones: Other anemones | 11 229000 | CNTRO |
| 11 164000 | Cnidaria: Tube anemones | 11 500000 | CNTU |
| 27 000000 | Crustacea | 80 000000 | CR |
| 27 500000 | Crustacea: Barnacles | 27 000000 | CRB |
| 27 500902 | Crustacea: Barnacles: Acorn | 27 500000 | CRBA |
| 27 500901 | Crustacea: Barnacles: Stalked | 27 500000 | CRBS |
| 28 000903 | Crustacea: Crabs | 27 000000 | CRC |
| 28 836000 | Crustacea: Crabs: King crabs | 28 000903 | CRCK |
| 28 843000 | Crustacea: Crabs: Porcelain crabs | 28 000903 | CRCP |
| 28 850000 | Crustacea: Crabs: True crabs | 28 000903 | CRCT |
| 28 825901 | Crustacea: Hermit crabs | 27 000000 | CRH |
| 28 825902 | Crustacea: Hermit crabs: With shell or stone home | 28 825901 | CRHWZ |
| 28 825903 | Crustacea: Hermit crabs: With anemones | 28 825901 | CRHGS |
| 28 000902 | Crustacea: Lobsters | 27 000000 | CRL |
| 28 820000 | Crustacea: Lobsters: Rock lobsters | 28 000902 | CRLR |
| 28 821000 | Crustacea: Lobsters: Slipper lobsters / bugs | 28 000902 | CRLSL |
| 28 825904 | Crustacea: Lobsters: Squat lobsters | 28 000902 | CRLSQ |
| 28 786000 | Crustacea: Lobsters: True lobsters | 28 000902 | CRLT |
| 28 000901 | Crustacea: Prawns / shrimps / mysids | 27 000000 | CRP |
| 25 000000 | Echinoderms | 80 000000 | E |
| 25 001000 | Echinoderms: Feather stars | 25 000000 | EF |
| 25 001901 | Echinoderms: Feather stars: Stalked crinoids | 25 001000 | EFS |
| 25 001902 | Echinoderms: Feather stars: Unstalked crinoids | 25 001000 | EFU |
| 25 160000 | Echinoderms: Ophiuroids | 25 000000 | EO |
| 25 160902 | Echinoderms: Ophiuroids: Basket stars | 25 160000 | EOBS |
| 25 160901 | Echinoderms: Ophiuroids: Brittle / snake stars | 25 160000 | EOBSS |
| 25 400000 | Echinoderms: Sea cucumbers | 25 000000 | ESC |
| 25 400901 | Echinoderms: Sea cucumbers: Benthic | 25 400000 | ESCB |
| 25 400902 | Echinoderms: Sea cucumbers: Pelagic / swimming | 25 400000 | ESCP |
| 25 102000 | Echinoderms: Sea stars | 25 000000 | ESS |
| 25 200000 | Echinoderms: Sea urchins | 25 000000 | ESU |
| 25 200902 | Echinoderms: Sea urchins: Irregular urchins | 25 200000 | ESUI |

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|-----------|---|-----------|---------|
| 25 200901 | Echinoderms: Sea urchins: Regular urchins | 25 200000 | ESUR |
| 37 000000 | Fishes | 80 000000 | F |
| 37 990083 | Fishes: Bony fishes | 37 000000 | FB |
| 37 990025 | Fishes: Eels | 37 000000 | FEE |
| 37 990082 | Fishes: Elasmobranchs | 37 000000 | FEL |
| 37 990028 | Fishes: Elasmobranchs: Chimaeras | 37 990082 | FELC |
| 37 990030 | Fishes: Elasmobranchs: Rays & skates | 37 990082 | FELR |
| 37 990016 | Fishes: Elasmobranchs: Sharks | 37 990082 | FELS |
| 80 600903 | Jellies | 80 000000 | J |
| 12 000000 | Jellies: Ctenophores | 80 600903 | JCT |
| 11 150000 | Jellies: Cubozoa | 80 600903 | JCU |
| 11 000901 | Jellies: Hydromedusae | 80 600903 | JH |
| 35 101000 | Jellies: Pyrosomes | 80 600903 | JP |
| 35 100000 | Jellies: Salps | 80 600903 | JSA |
| 11 120000 | Jellies: Scyphozoa | 80 600903 | JSC |
| 11 090000 | Jellies: Siphonophores | 80 600903 | JSI |
| 80 300000 | Macroalgae | 80 000000 | MA |
| 80 300911 | Macroalgae: Articulated calcareous | 80 300000 | MAA |
| 80 300912 | Macroalgae: Articulated calcareous: Green | 80 300911 | MAAG |
| 80 300913 | Macroalgae: Articulated calcareous: Red | 80 300911 | MAAR |
| 80 300926 | Macroalgae: Encrusting | 80 300000 | MAEN |
| 80 300927 | Macroalgae: Encrusting: Brown | 80 300926 | MAENB |
| 80 300928 | Macroalgae: Encrusting: Green | 80 300926 | MAENG |
| 80 300929 | Macroalgae: Encrusting: Red | 80 300926 | MAENR |
| 80 300934 | Macroalgae: Encrusting: Red: Calcareous | 80 300929 | MAENRC |
| 80 300935 | Macroalgae: Encrusting: Red: Non-calcareous | 80 300929 | MEANRNC |
| 80 300903 | Macroalgae: Erect coarse branching | 80 300000 | MAEC |
| 80 300904 | Macroalgae: Erect coarse branching: Brown | 80 300903 | MAECB |
| 80 300905 | Macroalgae: Erect coarse branching: Green | 80 300903 | MAECG |
| 80 300906 | Macroalgae: Erect coarse branching: Red | 80 300903 | MAECR |
| 80 300907 | Macroalgae: Erect fine branching | 80 300000 | MAEF |
| 80 300908 | Macroalgae: Erect fine branching: Brown | 80 300907 | MAEFB |
| 80 300909 | Macroalgae: Erect fine branching: Green | 80 300907 | MAEFG |

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|-----------|--|-----------|-------|
| 80 300910 | Macroalgae: Erect fine branching: Red | 80 300907 | MAEFR |
| 80 300930 | Macroalgae: Filamentous / filiform | 80 300000 | MAF |
| 80 300931 | Macroalgae: Filamentous / filiform: Brown | 80 300930 | MAFB |
| 80 300932 | Macroalgae: Filamentous / filiform: Green | 80 300930 | MAFG |
| 80 300933 | Macroalgae: Filamentous / filiform: Red | 80 300930 | MAFR |
| 80 300914 | Macroalgae: Globose / saccate | 80 300000 | MAG |
| 80 300915 | Macroalgae: Globose / saccate: Brown | 80 300914 | MAGB |
| 80 300916 | Macroalgae: Globose / saccate: Green | 80 300914 | MAGG |
| 80 300917 | Macroalgae: Globose / saccate: Red | 80 300914 | MAGR |
| 80 300918 | Macroalgae: Laminate | 80 300000 | MALA |
| 80 300919 | Macroalgae: Laminate: Brown | 80 300918 | MALAB |
| 80 300920 | Macroalgae: Laminate: Green | 80 300918 | MALAG |
| 80 300921 | Macroalgae: Laminate: Red | 80 300918 | MALAR |
| 80 300901 | Macroalgae: Large canopy-forming | 80 300000 | MALC |
| 80 300902 | Macroalgae: Large canopy-forming: Brown | 80 300901 | MALCB |
| 80 300922 | Macroalgae: Sheet-like / membranous | 80 300000 | MAS |
| 80 300923 | Macroalgae: Sheet-like / membranous: Brown | 80 300922 | MASB |
| 80 300924 | Macroalgae: Sheet-like / membranous: Green | 80 300922 | MASG |
| 80 300925 | Macroalgae: Sheet-like / membranous: Red | 80 300922 | MASR |
| 23 000000 | Molluscs | 80 000000 | MO |
| 23 199000 | Molluscs: Bivalves | 23 000000 | MOB |
| 23 590000 | Molluscs: Cephalopods | 23 000000 | MOCE |
| 23 607000 | Molluscs: Cephalopods: Cuttlefish | 23 590000 | MOCEC |
| 23 650000 | Molluscs: Cephalopods: Octopods | 23 590000 | MOCEO |
| 23 615000 | Molluscs: Cephalopods: Squid | 23 590000 | MOCES |
| 23 100000 | Molluscs: Chitons | 23 000000 | MOCH |
| 24 000000 | Molluscs: Gastropods | 23 000000 | MOG |
| 33 000000 | Sea spiders | 80 000000 | SS |
| 63 600901 | Seagrasses | 80 000000 | SEAG |
| 63 600902 | Seagrasses: Elliptical leaves | 63 600901 | SEAGE |
| 63 600903 | Seagrasses: Strap-like leaves | 63 600901 | SEAGS |
| 10 000000 | Sponges | 80 000000 | SP |
| 10 000901 | Sponges: Crusts | 10 000000 | SPC |

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|-----------|--|-----------|--------|
| 10 000917 | Sponges: Crusts: Creeping / ramose | 10 000901 | SPCCR |
| 10 000902 | Sponges: Crusts: Encrusting | 10 000901 | SPCE |
| 10 000921 | Sponges: Crusts: Endolithic / bioeroding | 10 000901 | SPCEB |
| 10 000909 | Sponges: Cup-like | 10 000000 | SPCL |
| 10 000907 | Sponges: Cup-like: Barrels | 10 000909 | SPCLB |
| 10 000910 | Sponges: Cup-like: Cups | 10 000909 | SPCLC |
| 10 000919 | Sponges: Cup-like: Cups: Cup / goblet | 10 000910 | SPCLCG |
| 10 000918 | Sponges: Cup-like: Cups: Incomplete cup / curled fan | 10 000910 | SPCLCI |
| 10 000920 | Sponges: Cup-like: Cups: Tables / discs | 10 000910 | SPCLCT |
| 10 000911 | Sponges: Cup-like: Tubes and chimneys | 10 000909 | SPCLTC |
| 10 000912 | Sponges: Erect forms | 10 000000 | SPE |
| 10 000915 | Sponges: Erect forms: Branching | 10 000912 | SPEB |
| 10 000913 | Sponges: Erect forms: Laminar | 10 000912 | SPEL |
| 10 000914 | Sponges: Erect forms: Palmate | 10 000912 | SPEP |
| 10 000916 | Sponges: Erect forms: Simple | 10 000912 | SPES |
| 10 000906 | Sponges: Erect forms: Stalked | 10 000912 | SPMST |
| 10 000903 | Sponges: Massive forms | 10 000000 | SPM |
| 10 000905 | Sponges: Massive forms: Balls | 10 000903 | SPMR |
| 10 000908 | Sponges: Massive forms: Cryptic | 10 000903 | SPMC |
| 10 000904 | Sponges: Massive forms: Simple | 10 000903 | SPMSI |
| 80 600901 | Worms | 80 000000 | W |
| 36 110000 | Worms: Acorn worms | 80 600901 | WA |
| 17 020000 | Worms: Echiura | 80 600901 | WEE |
| 13 000000 | Worms: Flatworms | 80 600901 | WF |
| 15 400000 | Worms: Penisworms | 80 600901 | WPE |
| 22 000000 | Worms: Polychaetes | 80 600901 | WPO |
| 22 000902 | Worms: Polychaetes: Other polychaetes | 22 000000 | WPOO |
| 22 000901 | Worms: Polychaetes: Tube worms | 22 000000 | WPOT |
| 17 000000 | Worms: Sipuncula | 80 600901 | WES |