Guam Coral Geodatabase
Final Summary Report
For NOAA

National Oceanic and Atmospheric Administration

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Logistical and Administrative Support to Improve Coral Reef Ecosystem-Based Management for the Pacific Island Managed and Protected Area Community Network (PIMPAC)

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This report covers activities since the last progress report dated September 10, 2014, and provides a final project summary. The final database presentation was held on September 26, 2014. The features of the database were discussed and it was determined that there were no records of the four species that have been officially listed as Threatened on Guam. David Burdick stated that he had personal observations of some of these species and provided these records after the meeting. These additional data were incorporated into the finalized database, submitted with this report in October 2014. Additional comments from Valerie Brown were that metadata would be required for the final database submission. This information has been added to the database for the "Observations" feature class in which all submitted data are compiled.

Data Collection and Mining

Digital datasets were provided by the University of Guam Marine Laboratory (UOGML) Coral Health surveys, NOAA MARAMP cruises, Guam Coral Reef Long-Term Monitoring Program and David Burdick, personal observations. These datasets were modified as little as possible before being incorporated into the project database. One clear misspelling was changed in the Long-Term Monitoring data, and three records in the Coral Health data that appeared to be data entry errors were removed. Non-digital data were gathered from UOGML technical reports written by authors identified by stake holders as highest priority. All available technical reports with these authors were reviewed for additional records of the 40 species of interest identified by project stake holders (see Appendix 1 for list of references). A total of 21 reports were searched for data, of which 10 contained records of species of interest; references to 8 other publications were found, but full copies could not be accessed. Only records of the species of interest to this project were added to the database from the technical reports. Data were then filtered to only include the parameters identified during the kick-off meeting and which had broad applicability across the various datasets (described below). This was to limit the number of fields with little to no information. Finally, all data were incorporated into the project database.

Geodatabase Development

Only data provided within the available datasets were entered into the project database. No data were synthesized by HIES. The fields used in the project database are described below:

- Latitude – accuracy of this field is determined by precision of source data.
- Longitude – accuracy of this field is determined by precision of source data.
- Species_Code – a unique code for each entry, allows searching for every record of a species even when data sources use different nomenclature for the species name (i.e. searching for ASPE will find all "Acropora species" entries regardless if entered as species, spp or sp).
- Species_Name – this field was not altered except for clear spelling errors
- Genus – allows searching for all species within a genus.
- Obs_Date – date provided from original data. Some entries from same dataset did not have this information, but was populated by HIES based on information provided from data source.
- Reef_Zone – from original data, listed as "forereef", "reef flat margin – East", "reef flat margin – West", "reef slope – terrace", and "reef slope – west".
- Depth – numerical value of vertical depth of record, may be a general description of the transect depth within which the coral was found.
- Size_Class – numerical value or range of the size of the coral specimen.
- Obs_Count – how many specimens were counted for this record.
- Abundance – mostly a numerical value; some data sources provided frequency rather than abundance. This is indicated in the record entries. Some UOGML technical reports provided only qualitative categories of abundance with no qualitative description of these categories.
- Exposure – entered at the request of stake holders with understanding that would be populated by them at a future date.
- Loc_Precision – an indication of how accurate the GPS entries are for each data source. "Coordinate" indicates a GPS point for each record was provided. "Transect" indicates a GPS point was provided for the center point of a transect within which the record is grouped. "Site" indicates that no GPS information was provided, only a qualitative description of the study site.

- Island – MARAMP data included records from other Marianas Islands, so this field was added for reference.
- Data_Source – each source was assigned a numerical value, which is found in this field. The reference table "Data_Sources" provides detailed information about each source by number.
- Management Concern – can be one of four categories: Threatened- the four species officially listed; Not warranted for listing – the remaining 26 species that were considered, but not listed; Local concern – the 10 additional species identified by stake holders as being of local interest; N/A or "NULL" – the remaining records. This field is from the reference table "Species_Code", which has been joined to the "Observation" feature class. The join allows for easy updating of this field within the "Species_Code" table rather than for every record within the "Observation" feature class. Irrelevant records from the "Species_Code" table have been turned off.

The feature class "Observations" has been copied to the ArcMap work space three additional times and renamed the following: "Threatened", "Local concern" and "Not warranted for listing". Each of these feature classes has had a definition query applied so that only the records with these specific threat categories will be displayed on the map or in the attribute table. This allows the user to turn on the desired feature class and only see the records of interest.

Four reference tables have also been added to the database to provide the user with additional pertinent information. These tables are described below.

- Data Sources – a bibliography of sources for data found in the "Observations" table.
- Loc_Precision – a description of each category in this field within the "Observations" attribute table.
- Species_Code – a comprehensive list of every species code entry within the "Observations" table. Includes additional information such as Family and species name. The field "Original_Data_Spp_Code" is a list of species codes from the original data sources. Most of the database species codes are the same as in the original data. Only codes that were not unique or where more than one code was used for the same species were changed.

- Species_of_Interest – a subset of the “Species_Code” table that only lists the 40 species of interest for this project as a quick reference source.

Final Data Summary

The final database included 84, 088 records from 30 different sources. Of these records, 760 were of species considered, but not warranted for listing (Appendix 2); 358 were species of local concern (Appendix 3); and 28 were of threatened species (Appendix 4). The 28 records of threatened species were added after the final presentation meeting when it was determined that no records of the four threatened species were present. Personal observation data were then provided by David Burdick with at least one record of each of the four listed species.

Appendix 1

Data Sources

Digital data source descriptions:

Data Source	Provider	Description
LTM_Disease_Haputo_6-29-12	Laurie Raymundo	Coral health data, a subset of the UOG Reef Flat Monitoring Program
LTM_Disease_Luminao_9-19-12	Laurie Raymundo	Coral health data, a subset of the UOG Reef Flat Monitoring Program
LTM_Disease_Piti_6-14-12	Laurie Raymundo	Coral health data, a subset of the UOG Reef Flat Monitoring Program
LTM_Disease_Piti_9-13-12	Laurie Raymundo	Coral health data, a subset of the UOG Reef Flat Monitoring Program
LTM_Disease_Tanguisson_6-25-12	Laurie Raymundo	Coral health data, a subset of the UOG Reef Flat Monitoring Program
LTM_Disease_TUMON_6-6-12	Laurie Raymundo	Coral health data, a subset of the UOG Reef Flat Monitoring Program
LTM_Disease_Tumon_9-14-12	Laurie Raymundo	Coral health data, a subset of the UOG Reef Flat Monitoring Program
LTM_Disease_WAGANA_6-8-12	Laurie Raymundo	Coral health data, a subset of the UOG Reef Flat Monitoring Program
LTM_Luminao_Disease_6-12-12	Laurie Raymundo	Coral health data, a subset of the UOG Reef Flat Monitoring Program
coral_quadrat_observations20140129_updated	David Burdick	Coral quadrat data collected as part of Guam's Long-term Coral Reef Monitoring Program funded by NOAA Coral Reef Conservation Program
V0_CORAL_DZ_OBS_A MARIAN	Troy Kanemura	MARAMP Benthic Data
V0_CORAL_OBS_A MARIAN	Troy Kanemura	MARAMP Benthic Data
V0_CORAL_OBS_C MARIAN	Troy Kanemura	MARAMP Benthic Data
Colgan_1987	MarineLab Archive	Coral reef recovery on Guam (Micronesia) after catastrophic predation by Acanthaster planci. Ecology 68(6): 1592-1605
Randall_1973	MarineLab Archive	Coral reef recovery following extensive damage by the "crown of thorns" starfish, Acanthaster planci (L.). Publications of the Seto Marine Biological Laboratory 20:469-489.
UOGML_TechReport_80	MarineLab Archive	Randall and Sherwood. 1982. Resurvey of Cocos Lagoon, Guam, Territory of Guam.
UOGML_TechReport_76	MarineLab Archive	Colgan. 1981. Long-term recovery process of a coral community after a catastrophic disturbance
UOGML_TechReport_11	MarineLab Archive	Jones, Randall, Strong. 1974. An investigation of the biological and oceanographic suitability of Toguan Bay, Guam as a potential site for ocean outfall.
UOGML_TechReport_79	MarineLab Archive	Randall and Eldredge. 1982. Assessment of the shoalwater environments in the vicinity of the proposed OTEC development at Cabras Island, Guam.
UOGML_TechReport_7	MarineLab Archive	Jones and Randall. 1973. A study of biological impact caused by natural and man-induced changes on a tropical reef.
UOGML_TechReport_47	MarineLab Archive	Randall and Birkeland. 1978. Guam's reefs and beaches part II sedimentation studies at Fouha Bay and Ylig Bay.
UOGML_TechReport_34	MarineLab Archive	Amesbury, et al. 1977. Marine environmental baseline report commercial report, Apra Harbor, Guam.
UOGML_TechReport_28	MarineLab Archive	Jones, Randall, Wilder. 1976. Biological impact caused by changes on a tropical reef.
UOGML_TechReport_17	MarineLab Archive	Randall et al. 1975. Marine biological survey of the Cocos barrier reef and enclosed lagoon.
UOGML_TechReport_102	MarineLab Archive	Amesbury et al. 1995. Andersen Air Force Base Marine Resources Preserve: baseline study of marine resources.
Burdick, D. Personal Observation, 2006	David Burdick	2006, photos available
Burdick, D. Personal Observation, 2008	David Burdick	2008, photos available
Burdick, D. Personal Observation, 2010	David Burdick	2010, photos available
Burdick, D. Personal Observation, 2011	David Burdick	2011, photos available, identification not certain
Burdick, D. Coral bleaching response effort	David Burdick	Coral bleaching response effort, qualitative coral community surveys

Non-digital resources that were mined (asterisk indicates resources that contained information about at least one desired coral species):

*Amesbury, S.S., Birkeland, C., Chernin, M.I., Clayshulte, R., Cushing, F., Day, J.E., Dickinson,R., Eads, J., Eldridge L.G., Grosenbaugh-Hamel, D., Hedlund, S., Kock, R.L., Marsh, J.A., Neubauer, C., Neudecker, S., Randall, R.H., Tsuda, R.T. 1977. Marine Environmental Baseline Report Commercial Port, Apra Harbor, Guam. UOG Technical Report # 34. *(presence of target spp only, no quantitative data)*

Becerro, M.A., V. Bonito, & V.J. Paul. 2006. Effects of monsoon-driven wave action on coral reefs on Guam and implications for coral recruitment. Coral Reefs 25:193–199.

Birkeland, C. 1988. Geographic comparisons of coral--reef community processes. Proceedings of the 6th International Coral Reef Symposium, Australia, 1988, Vol. 1.

*Colgan, M. 1981 Long-term recovery process of a coral community after a catastrophic disturbance. Marine Laboratory Technical Report # 76.

*Colgan, MW. 1987. Coral reef recovery on Guam (Micronesia) after catastrophic predation by *Acanthaster planci*. Ecology 68(6): 1592-1605.

*Jones, R. and Randall, R. 1973 A study of biological impact caused by natural and man-induced changes on a tropical reef. Marine Laboratory Techincal Report #7.

*Jones, R., Randall, R., and Strong, R. 1974 An investigation of the biological and oceanographic suitability of Toguan Bay, Guam as a potential site for an ocean outfall. Marine Laboratory Technical Report #11.

*Jones, R.S., R.H. Randall, & M.J. Wilder. 1976. Biological impact caused by changes on a tropical reef. (*also* EPA-600/3-76-027). 209 pages.

Paulay, G**.** 1994. Biodiversity on oceanic islands: Its origin and extinction. American Zoologist 34:134–144.

Paulay, G. 2003. Marine biodiversity of Guam and the Marianas: overview. Micronesica 35-36:3-25.

Paulay, G. 2003. The Bivalvia (Mollusca) of Guam. Micronesica 35-36: 218-243. PDF available

Paulay, G. and Y. Benayahu. 1999. Patterns and consequences of coral bleaching in Micronesia (Majuro and Guam) in 1992-1994. Micronesica 31(2): 109-124. PDF Available

Paulay, G and A Ross. 2003. An annotated checklist of the shallow water Cirripedia of Guam. Micronesica 35-36: 303-314. PDF available

*Randall, R.H. 1973. Coral reef recovery following extensive damage by the "crown–of–thorns" starfish, *Acanthaster planci* (L.). Publications of the Seto Marine Biological Laboratory 20: 469–489.

Randall, R. 1974. Talafofo Bay coastal survey, Marine Laboratory Technical Report # 13.

Randall, RH. 2003. An annotated checklist of hydrozoan and scleractinian corals collected from Guamand other Mariana Islands. Micronesica 35-36: 121-137.

*Randall, R.H., Birkeland, C. 1978. Guam's Reefs and Beaches Part II Sedimentation Studies at Fouha Bay and Ylig Bay. UOG Marine Lab Technical Report # 47.

*Randall, R. and Eldredge, L. 1982 Assessment of the shoalwater environments in the vicinity of the proposed OTEC development at Cabras island, Guam. Marine Laboratory Technical Report # 79.

*Randall, R. and Sherwood T. 1982 Resurvey of Cocos Lagoon, Guam, territory of Guam. Marine Laboratory Technical Report # 80.

Randall, R.H., R.T. Tsuda, R.S. Jones, M.J. Gawel, J.A. Chase, & R. Rechebei. 1975. Marine biological survey of the Cocos barrier reef and enclosed lagoon. 160 pages.

Wolanski, E., R.H. Richmond, G. Davis, & V. Bonito. 2003. Water and fine sediment dynamics in transient river plumes in a small, reef-fringed bay, Guam. Estuarine, Coastal and Shelf Science 56: 1–13.

Resources by authors of interest for which copies could not be located:

Birkeland, C., D. Rowley, & R.H. Randall. 1982. Coral recruitment patterns at Guam. Proceedings of the 4th International Coral Reef Symposium, Manila 2:339–344.

Colgan, M.W. 1984. The Cretaceous coral *Heliopora*(Octocorallia: Coenothecalia)—a common Indo–Pacific reef builder. Pages 266–271 in N. Eldredge& S.M. Stanley, editors. Living Fossils. Casebooks in Earth Sciences, Springer–Verlag.

Colgan, M.W. 1984. The Cretaceous coral *Heliopora*(Octocorallia: Coenothecalia)—a common Indo–Pacific reef builder. Pages 266–271 in N. Eldredge& S.M. Stanley, editors. Living Fossils. Casebooks in Earth Sciences, Springer–Verlag.

Colgan, M.W. 1982. Succession and recovery of a coral reef after predation by *Acanthasterplanci*(L.). Proceedings of the 4th International Coral Reef Symposium, Manila 2:333–338.

Randall, R.H. 1982. Morphologic diversity in the scleractinian genus *Acropora*. Proceedings of the 4th International Coral Reef Symposium, Manila 2:157–164.

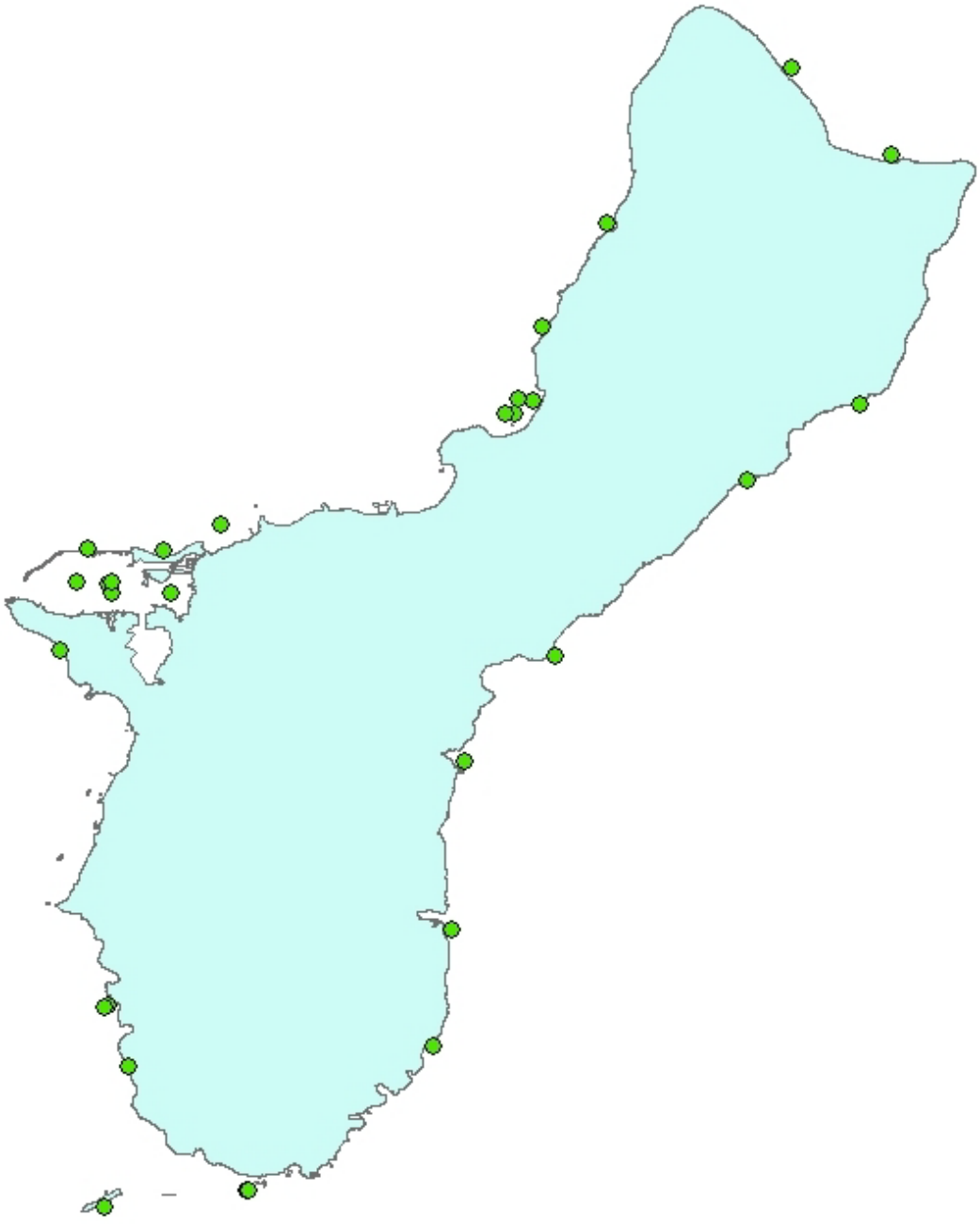
Randall, R.H. 2008. Holocene reef and beach development at Tumon Bay, Guam.

Siegrist, H.G., Jr., R.H. Randall, & A.W. Siegrist. 1984. Petrography of the Merizo limestone, an emergent Holocene reef, Ylig Point, Guam. Palaeontographica Americana 54:399–405.

Siegrist, A.W., R.H. Randall, & H.G. Siegrist, Jr. 1984. Functional morphological group variation within an emergent Holocene reef, Ylig Point, Guam.Palaeontographica Americana 54:390–393.

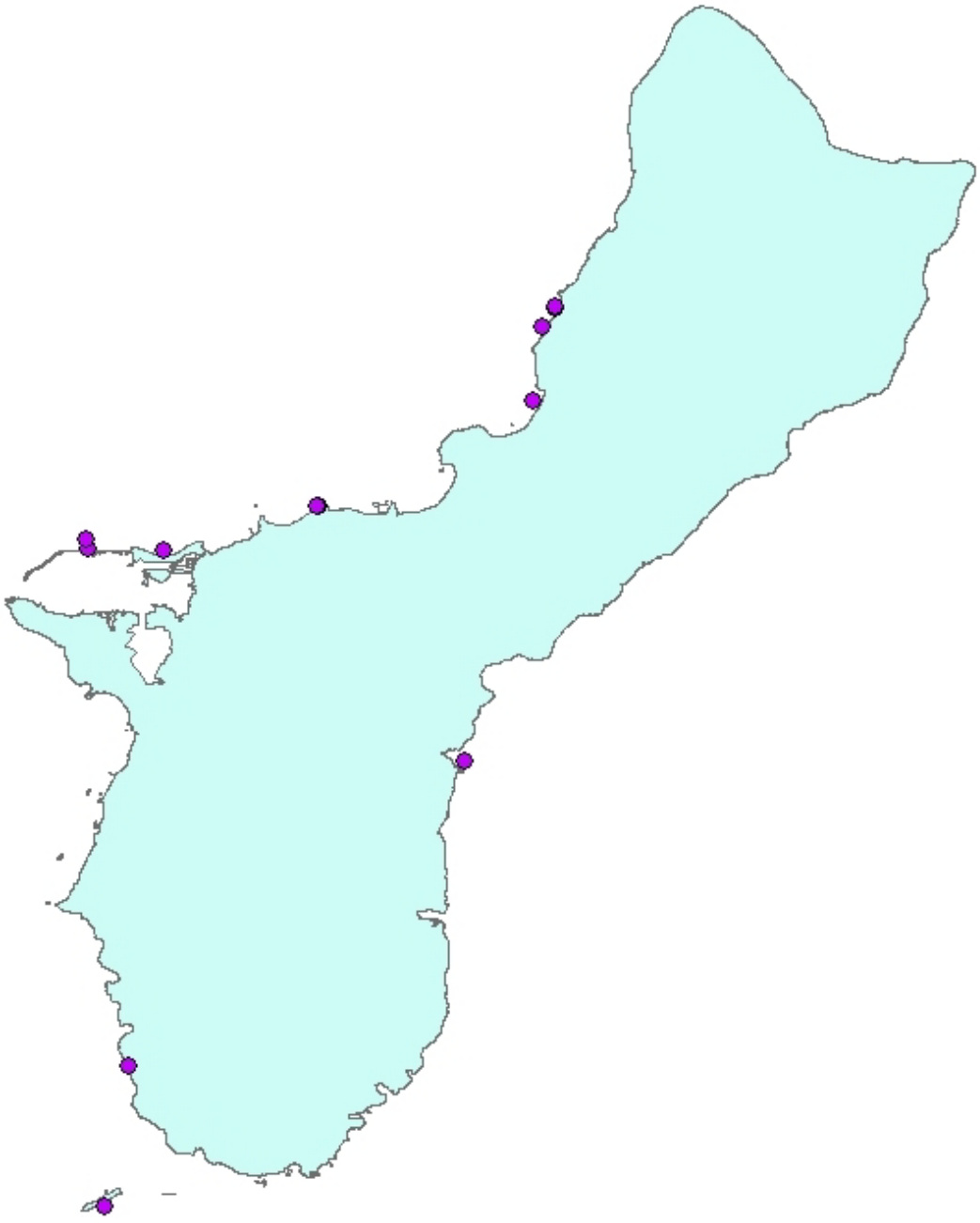
Appendix 2

Records of Species Not Warranted for Listing as Threatened



Appendix 3

Records of Species of Local Concern



Appendix 4

Records of Threatened Species