CEPF FINAL PROJECT COMPLETION REPORT

I. BASIC DATA

Organization Legal Name: The University of Southern Mississippi

Project Title (as stated in the grant agreement): Biogeographical Patterns of Freshwater Fishes in Honduras

Implementation Partners for this Project: None

Project Dates (as stated in the grant agreement): 1 October 2007 – 1 October 2008

Date of Report (month/year): November 2008

II. OPENING REMARKS

Provide any opening remarks that may assist in the review of this report.

Project Background

As is true in many developing countries, biological research in Mesoamerica has focused primary on applied aspects. This is especially true for ichthyological research as fisheries are often a vital component of the economy. A consequence of this applied focus is that the necessary foundations in taxonomic, biogeographical and ecological expertise are largely missing. The resulting well intentioned yet uninformed management decisions aimed at improving fishery yields can have long term negative effects on local ecosystems (eg. Lates niloticus introduction into Lake Victoria, Africa).

There are currently 4,475 recognized species of freshwater fishes in Central and South America (Reis et al. 2003) with estimated numbers of undescribed species ranging from 1,500 to 3,500 (Reis et al. 2003). By even the most conservative estimates, large portions (up to 25%) of the Central American fish fauna remain undescribed and biogeographical data for most taxa are simply incomplete. Within Central America, Honduras is generally regarded as the country with the least studied ichthyofauna. Not surprisingly, initial surveys (2005 and 2006) within Honduras yielded valuable taxonomic and biogeogaphic information (see Preliminary Data below). Numerous authors have cited the need for systematic studies of the freshwater fishes of Honduras (Carr & Giovannoli 1950, Miller 1966, Lyons 2005, Matamoros et al. 2007) and Mesoamerica in general (Greenwood 1992, Smith & Birmingham 2005).

Preliminary Work on Honduran Ichthyofauna

Wilfredo Matamoros, a doctoral student at the University of Southern Mississippi, began sampling freshwater fishes from the small northern Caribbean drainages and sporadically through the larger southern (Pacific) Choluteca River drainage in 2005 and 2006. This ongoing effort covered roughly 25% of the country and yielded a wealth of taxonomic (discovery of new species), biogeographic (records of species not previously sampled in the country) and ecological (changes in our understanding of species fundamental habitats use) advances for the region.

The purpose of this project was to investigate the biogeographical patterns of Honduran obligate freshwater fishes and fill gaps in our understanding of freshwater fish diversity and ecology. We proposed to examine regional and local processes in order to

understand contemporaneous distribution of freshwater fishes. We will describe Honduran biogeographical provinces, and quantify patterns of richness and endemism at the scale of the biogeographical provinces in order to document the physiographical and regional influences on the dispersal and diversification history of Honduran freshwater ichthyofauna. An important component of this research will involve informing the public and stakeholders of the diversity in the region. In addition, students will be trained in modern systematic and ecological techniques used to sample and identify freshwater fishes. Finally, we will present the freshwater fishes that we believe are most in need of conservation action due to their restricted ranges or potentially small population sizes.

The data presented in this report is inclusive of the four years of field and laboratory work that has gone into this project. CEPF was generous enough to support the work for one of those years. The three appendices included are 1) a formal list of all of the freshwater fishes known in Honduras, 2) maps of the ichthyological provinces of Honduras including known locality for the five most imperiled fishes in the country and 3) a matrix of known occurrences of all fishes by the 19 drainages. All three of these appendices are a major component of the works that we are preparing for publication. Thus, they are in some respect works in progress that may be revised over time. There is also a great deal of systematic work that remains to be done. We have described one new species in the country and anticipate describing many more. We are working on collecting the molecular and morphological data needed to describe these new species. Any putative new species here and in the appendix are described with the specific epithet “sp”.

III. ACHIEVEMENT OF PROJECT PURPOSE

***Project Purpose**: Publication and distribution of a complete list of freshwater fishes of Honduras, including a dichotomous key, and descriptions of previously undescribed endemics. Conservation recommendations provided to regional NGO, and a list of species of concern prepared for IUCN red listing.*

Planned vs. Actual Performance

Indicator	Actual at Completion
Purpose-level: Publication and distribution of a complete list of freshwater fishes of Honduras, including a dichotomous key, and descriptions of previously undescribed endemics. Conservation recommendations provided to regional NGO, and a list of species of concern prepared for IUCN red listing	Freshwater fish diversity in Honduras is somewhat higher than expected. We have described one new species (*Profundulus protilorum*) that is most likely endemic to the Ulua River system and in need of immediate conservation evaluation. We are still in the process of identifying other potentially new species. We have molecular and morphological data indicating there are likely many undescribed endemic species in need of description. Given that their ranges will also be fairly small, they will also be of conservation concern. We have produced an updated complete list of freshwater fishes (see attached Appendix 1). Given that our taxonomic work remains unfinished, we acknowledge this list is incomplete. For this list, species that we believe will eventually be described are listed as “sp.”. We have recognized the following five species as most imperiled and in need of IUCN listing and conservation action. We have limited information

	on the biology of these species. For many of them, the collections we made and the data we collection represent the information on these species. *Amphilophus hogaboomorum* – distribution limited to the lower reaches of the Rio Choluteca and Rio Negro *Theraps wesseli* – Previously known only from one location in the Papaloteca River. During this research we located this species in the Rio Cangrejal and Rio Danto. *Profundulus portillorum* – Endemic species discovered during this project. Endemic to the Ulua and Nacaome rivers. *Profundulus* sp. – Endemic species we are working on describing. Only known from two localities in the Ulua drainage. Sicydium sp. – One of three undescribed species of goby discovered during this project. We are working to describe these species. They are found in the Lean, Cangrejal, Lis Lis and Guanaja drainages.
1. Five (5) or more requests for information by interested parties, including conservation-related agencies, govornmnet agencies, or universities.	We have been contacted by a number of interested parties regarding this project. These include media organizations (discovery channel), researchers at other institutions (Louisiana State University, Texas A&M University, New York University, The Natural History Museum in Chicago, The Smithsonian Institute in Washington D.C.). Presentations made by request to the following government agencies on a regular basis: SERNA (Secretaria de Rercurson Naturales) COHCYT (Consejo Hondureno de Ciencia y Tecnologia) DIGEPESCA (Direccion General de Pesca) DIBIO (Direcion de Biodiversidad) National School of Forestry (ESNACIFOR)
2. Five (5) inquiries or reports from local media describing research activities.	Most of the reports and inquires regarding our activities have been through workshops, scientific meetings and the scientific literature. We were contacted by the Discovery channel in regards to a phenomenon where fishes are thought to “rain”. It is our understanding that these discussions will be part of a future documentary.
3. Five (5) scientific publications/presentations or media reports documenting the results of this project.	Presentations made at workshops organized and/or participated in: November 2007 Mesoamerican Society for Biology and Conservation (MSBC) April 2008 The Southwestern Association of Naturalists (Memphis, TN, USA). May 2008 el ministerio publico de Honduras (Tegucigalpa) The Univerisidad Nacional Autonoma de Honduras

	June 2008 The Universidad Autonoma de Honduras (UNAH) the National School of Forestry (ESNACIFOR) August 2008 WWF Techniques for Assess Biodiversity in Honduras September 2008 The Rainforest Alliance in Antigua Guatemala in September 2008
4. Minimum IUCN criteria for listing species is compiled for rare or narrowly ranged species. Criteria include: taxonomic description, name, range (drainages), current population estimates, rational for listing.	*Profundulus portilorum* is the first and most obvious species in need of IUCN listing. IUCN listing of this species is pending the acceptance of our manuscript with the official description of the species. IUCN listing of other species in need of concern (see above) will follow the publication of those species descriptions. Rare species in Honduras most in need of IUCN listing include: *Amphilophus hogaboomorum* *Theraps wesseli* *Profundulus* sp. Sicydium sp.

Describe the success of the project in terms of achieving its intended impact objective and performance indicators.
We believe the project was most successful in achieving all of our stated objectives. The diversity of freshwater fishes is greater than expected. While interesting from a scientific perspective, the need for conservation action is greater than expected.

Were there any unexpected impacts (positive or negative)?
Fuel prices spiked during our sampling period. This negatively affected the number of sites we could visit.

IV. PROJECT OUTPUTS

Project Outputs*: Enter the project outputs from the Logical Framework for the project*

Planned vs. Actual Performance

Indicator	Actual at Completion
Output 1: Data describing the freshwater fishes of Honduras. **Activities: Sample fish communities at 60 sites spread throughout all major drainages in Honduras. Complete alpha taxonomy work which will include descriptions of previously undescribed species. Compile complete species lists, a dichotomous key to freshwater fishes, and appropriate distributional maps highlighting areas of high diversity and endemism.**	
1.1 Complete sampling of 60 sites spread throughout all major drainages in Honduras. Identify species collected, describe new species.	Completed. We actually sampled 140 sites during the funded period. We have sampled 340 sites since the project began in 2004. All major drainages have been sampled.
1.2 A detailed list of freshwater fish	Completed, see Appendix 1 for a list of freshwater

species, their distributions and relative abundances for the country. The initial species lists will be available at the end of the sampling period (September 2008). As the identification of new species will likely take time, this list will be updated as progress is made. Publication of results in peer-reviewed journals will begin immediately, we anticipate publication of early results in 2009.	fishes in Honduras. The attached list will be part of a future formal publication describing the fishes of Honduras. Species that remain undescribed are also listed. Publications describing have been submitted or are in preparation.
Output 2: The scientific community and local, regional and internal actors are aware of the results of this research. **Activities: Present results at national and international scientific meetings. Publish and disseminate manuscripts, maps, species lists to NGO's and other conservation agencies. Provide management recommendations to government authorities for implementation of meaningful conservation action based on species distributions and perceived threats to diversity. submit appropriate species for IUCN listing. Present findings at the 2008 SMBC meetings.**	
2.1 One (1) detailed interactive GIS map of the icthyological provinces for the country and their hotspots for use by conservation agencies.	See attached Appendix 2. Real time interactive maps describing the collections are also available at http://ichthyology.usm.edu/usm/ Presentations describing biogeographical provinces made to: SERNA (Secretaria de Rercurson Naturales) COHCYT (Consejo Hondureno de Ciencia y Tecnologia) DIGEPESCA (Direccion General de Pesca) DIBIO (Direcion de Biodiversidad) National School of Forestry (ESNACIFOR)
2.2 One (1) report presented at 2008 SMBC meeting, and 2008 American Society of Ichthyologists and Herpetologists Meeting.	Completed. Presentations made at the 2007 (preliminary) and 2008 SMBC meetings. Presentation made at the 2008 Southwestern Association of Naturalists meeting.
2.3 One (1) report authored containing a species list and a series of conservation management recommendations for government authorities.	Completed. See attached detailed species list and associated conservation recommendations.
2.4 Attend monthly workshops at the Honduran Directorate for Biodiversity and bimonthly Department of Forestry workshops. Present research progress and appropriate conservation information at workshops.	Completed. Presentations made by request to the following government agencies on a regular basis: SERNA (Secretaria de Rercurson Naturales) COHCYT (Consejo Hondureno de Ciencia y Tecnologia) DIGEPESCA (Direccion General de Pesca) DIBIO (Direcion de Biodiversidad) National School of Forestry (ESNACIFOR)
Output 3: Train local taxonomists in necessary skills to conserve freshwater fishes. **Activities:Train local taxonomists and scientists so that freshwater fish conservation knowledge is distributed. As an educational tool, provide a properly curated set of voucher samples (including dichotomous keys and field notes) to Zamorano. These samples will serve as a starting point for a national ichthyological collection. Voucher samples will include at least one example of all species collected as part of this project.**	
3.1 Ten (10) local students and scientists	Eight field technicians, guides and student helpers

will be involved during each project sampling period. Local students and scientists will be involved during each project sampling period.	from Universidad Nacional Autonoma De Honduras were trained: Fausto Valladares, Hermes Ponce, Hector Portillo, Jonathan Hernandez, Fabiola Leiva, Mario Vasquez, Edis Lopez, and Alejandra Sanchez. Three additional technicians employed as part of the project: Juan Carlos Lopez, Julio Ancheta and Tomas Manzanares.

Describe the success of the project in terms of delivering the intended outputs.

We have learned that the Honduran ichthyofauna is more diverse than expected and that there are a number of undescribed endemic species potentially in danger of extinction. In terms of identifying and quantifying fish diversity in Honduras, this project far exceeded our expectations. In some respects, this type of success can be viewed as both a positive and a negative. As ichthyologists we were very please to discover new species and document new range expansions into the country. As conservationists we were distressed to find out that some of these species and populations may be in immediate danger of extirpation. For example, they type locality (location where the first individuals were captured) for *Profundulus protilorum* is in a highly disturbed region. Upon returning to the site, we found it was being developed and no longer contained water. Thus, it is possible one of the few creeks known to contain this species is no longer habitable.

Were any outputs unrealized? If so, how has this affected the overall impact of the project?

The success of the project resulted in more Honduran fish diversity than expected. As a result, the systematics and taxonomy (identifying and describing biodiversity) are more difficult than expected. A full understanding of Honduran fish biodiversity and all necessary conservation actions will have to wait until this work is completed.

V. SAFEGUARD POLICY ASSESSMENTS

Provide a summary of the implementation of any required action toward the environmental and social safeguard policies within the project.

Not applicable.

VI. LESSONS LEARNED FROM THE PROJECT

Describe any lessons learned during the various phases of the project. Consider lessons both for future projects, as well as for CEPF's future performance.

The full taxonomy of the region must be understood before any conservation action is taken. We have learned that Honduras, and much of the surrounding region, is very diverse and has regions with high rates of endemism. In Honduras, many of these regions are understudied and the biodiversity neither documented or understood. Any conservation action taken without an understanding of what is being concerned has the potential to be more deleterious than beneficial. Thus, any and all conservation resources available in the region should be put to use documenting species distributions and population sizes.

Project Design Process: (aspects of the project design that contributed to its success/failure)

We believe the project design was well suited to our goals. Our design called for broad sampling of the entire country. We have sampled over 300 sites since 2004, covering the entire country. Areas that have been shown to contain large numbers of endemic species should be further sampled to provide better resolution.

Project Execution: (aspects of the project execution that contributed to its success/failure)

We relied heavily on collaborators at Zamorano and the Honduran national university. Without their logistic and personnel help we would not have had the success that we did in our field work.

VII. ADDITIONAL FUNDING

Provide details of any additional donors who supported this project and any funding secured for the project as a result of the CEPF grant or success of the project.

Donor	Type of Funding*	Amount	Notes
The University of Southern Mississippi	A	$30,735	Institutional matching funds.

Additional funding should be reported using the following categories:

- ***A*** *Project co-financing (Other donors contribute to the direct costs of this CEPF project)*
- ***B*** *Complementary funding (Other donors contribute to partner organizations that are working on a project linked with this CEPF project)*
- ***C*** *Grantee and Partner leveraging (Other donors contribute to your organization or a partner organization as a direct result of successes with this CEPF project.)*
- ***D*** *Regional/Portfolio leveraging (Other donors make large investments in a region because of CEPF investment or successes related to this project.)*

Provide details of whether this project will continue in the future and if so, how any additional funding already secured or fundraising plans will help ensure its sustainability.

Our intention is to continue this project by further studying the five species we feel are in need of immediate conservation action. For each of these species, our goals are to determine the range, abundance and the properties and extent of critical habitat. These data will be vital IUCN listing and a necessary component of any conservation plan.

At this time, we have no additional funding for this work. We are pursuing a number of potential funding sources. We believe the next conservation goal for Honduran freshwater fishes should be IUCN listing of the five most imperiled species (see below).

VIII. ADDITIONAL COMMENTS AND RECOMMENDATIONS

Conservation recommendations -

Basic distribution, population and demographic information is needed for the five species listed below. For many of these species, the are known from only a few collection made:

Amphilophus hogaboomorum – distribution limited to the lower reaches of the Rio Choluteca and Rio Negro

Theraps wesseli – Previously known only from one location in the Papaloteca River. During this research we located this species in the Rio Cangrejal and Rio Danto.

Profundulus portillorum – Endemic species discovered during this project. Endemic to the Ulua and Nacaome rivers.

Profundulus sp. – Endemic species we are working on describing. Only known from two localities in the Ulua drainage.

Sicydium sp. – One of three undescribed species of goby discovered during this project. We are working to describe these species. They are found in the Lean, Cangrejal, Lis Lis and Guanaja drainages.

Another long term research goal is to examine the structure of the ichthyofauna on a finer scale to look at more recent factors (eg. potential anthropogenic impacts) structuring fish distributions. Our approach here is to quantify the population structure of an abundant and broadly distributed species to produce a fine-scale biogeographic map for Honduran freshwater fishes. We have chosen *Astyanax aeneus*, an abundant tetra, for this project. We have collaborated with researchers at New Your University to study the population genetics of this species at over 50 localities.

VIII. INFORMATION SHARING

CEPF is committed to transparent operations and to helping civil society groups share experiences, lessons learned and results. One way we do this is by making programmatic project documents available on our Web site, www.cepf.net, and by marketing these in our newsletter and other communications.

These documents are accessed frequently by other CEPF grantees, potential partners, and the wider conservation community.

Please include your full contact details below:

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