Conservation Genetics for Improved Biodiversity and Resource Management in a Changing Mekong Delta

PEER Science Cycle 2 ***Grant #: 7***

Nha Trang University

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Application Form

Report Fields

Project name*

Conservation Genetics for Improved Biodiversity and Resource Management in a Changing Mekong Delta

Total budget*

$120,000.00

Country*

Choose from the list of eligible countries. If your country is only listed in the special categories list, please choose "Special category" at the bottom of the list.

Vietnam

Panel recommendation

Highly Competitive

Application Number

Application Number

7

Special categories (if applicable)

Please check the category that applies. If your country is already listed as eligible (see above), it is not required that your project fall within one of these categories to be eligible for review. If none of these categories applies, you can leave this question answered or choose "none".

Biodiversity Research in the Lower Mekong

Primary field of research*

Applicants are encouraged to consult the list of projects funded in Cycle 1 of PEER Science for examples of the topics and types of projects supported.

Biodiversity

If you chose "other", please list below your primary field of research. Proposals focused on basic science topics without clear relevance to USAID development objectives are strongly discouraged.

[Unanswered]

Secondary field of research

Please list a secondary field of research, if any.

Climate; Environment; Food Security

Principal investigator*

Dang Thuy Binh

Mission recommendation

[Unanswered]

Panel Comments

Jensen: - Excellent- This is a really excellent proposal. They want to look at population conductivity for fish species in the lower Mekong. They are using genetic methods using state of the art leap frog technology. From a science perspective, it's feasible and exciting. The US partner provided a detailed support letter. As for the development impact, the project involves a great number of participants, including direct support for many researchers, PhD students, and master's students. The PI is a young female investigator with a lot of expertise. The only criticism I have is that there are few interactions with fisheries managers

Hay: -Good to Excellent- I was impressed by the US partner's letter. The in-country PI is female, the synergy between the two sides is very good, and this is at the top of the proposals I reviewed. This is building on a foundation that's already there and can be sustained.

USAID/RDMA: It's quite strong.

E-mail of principal investigator*

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Telephone number*

0084904135750

Co-PI(s)

If any

[Unanswered]

Principal investigator's institution*

Institute for Biotechnology and Environment, Nha Trang University

Address of principal investigator's institution*

Institute for Biotechnology and Environment, Nha Trang University

02 Nguyen Dinh Chieu Street, Nha Trang City, Vietnam

Is your project a single institution or multiple institution project?*

Single institution awards are anticipated to range in size from $30,000 to $60,000 per year for one to three years. A few larger and more complex projects (those involving multiple institutions and/or multiple countries, with one of them serving as the lead) may receive up to $110,000 per year for up to three years.

Single institutition

Other developing country institutions involved (If any)

[Unanswered]

Proposed start date for your PEER Science proposal*

Please provide the date in (Month/Day/Year) format. Please be advised that decions will not be made before May, 2013

08/15/2013

Proposed end date for your PEER Science proposal*

Please provide the date in (Month/Day/Year) format. In order for a PEER Science proposal to be considered eligible for review, its requested duration may not extend more than twelve months beyond the official termination date of the U.S. partner's NSF award that is effective at the time the PEER Science proposal is submitted

08/15/2015

U.S. partner*

Kent E. Carpenter

U.S. partner's institution*

Old Dominion University

U.S. partner's e-mail

kcarpent@odu.edu

Title of U.S. partner's NSF award*

PIRE: Oirigins of HIhg Marine Biodiversity in the Indo-Malay-Philippie Archipelago: Transforming a Biodiversity Hotspot into a Rsearch and Education Hotspot

U.S. partner's NSF award number*

0730256

End date of your U.S. partner's NSF award*

Please provide the date in (Month/Day/Year) format.

08/31/2014

Comment: *Although end date in the website shows 8/31/2013, the website has in fact not been updated, the US PI has sent us a documentation proving that the award has been extended to 8/31/2014.*

You may save your application as a draft at any time and resume it later. To do so, please scroll down and click on the "Save as Draft" button at the bottom of the application page. Please do not use the back button or you will lose any unsaved information. To avoid any inconvenience, remember to save regularly while working on your application. For further instructions on each question, please consult the program instructions.

II- Project Summary

Please fill out both sections of the summary: scientific merit and development impact. There is a limit of 2500 characters for each section. The summary should be written so that readers without technical expertise can understand it. It should briefly and clearly state the goals of the project and the proposed activities that will be carried out to achieve them. The summary should also explain the role of the proposed U.S. collaborator and describe the anticipated outcomes of the project, including scientific merit (part 1) as well as development-related impacts (part 2). In describing these impacts, the specific focus should be on how the project relates to USAID's programmatic interests.

2.a) Scientific merit*

The study of the genetics of populations has become a valuable means to investigate the origins of the extreme biodiversity of SE Asia (e.g. Lukoschek et al. 2012, Carpenter et al. 2011). The National Science Foundation (NSF) Partnerships for International Research and Education (PIRE) project "Origins of high

marine biodiversity in the Indo-Malay-Philippine Archipelago" has extended phylogeographic studies to Vietnam and Thailand to better understand mechanisms of speciation in the marine realm of this region. This proposed PEER project extends this investigation into the estuarine and freshwater biomes of the most prominent and extremely biodiverse hydrological feature of SE Asia, the Mekong Delta. Connectivity of populations across and within the Mekong Delta are shaped by the complex and dynamic physical processes of the Mekong River Basin Mekong River Basin. The outflow of the Mekong River Basin will potentially serve as a barrier to gene flow of marine populations distributed along the coast of Vietnam similar to what is observed for the Amazon River (Rocha et al. 2002). Also similar to the Amazon system, the complex branches and hydrography of the Mekong Delta provide both potential barriers and environmental gradients that would influence gene flow and natural selection of vertebrate populations (e.g. Cooke et al. 2012, Hollatz 2011) within the Mekong Delta. This PEER project will examine fine-scale population connectivity of a marine, estuarine, and freshwater species across the MD using advanced genomic methodologies. This will initiate a long-term research program to investigate processes that promote lineage diversification across the MD and provide a basis to examine genetic adaptation of populations to the changing conditions of the MD caused by increasing effects of damming, development, agriculture and climate change.

2.b) Development impacts*

The study of the genetics of populations has become a valuable tool in conservation and resource management (Hauser & Seeb 2008, Reed & Frankham 2003) and is becoming increasingly used for Mekong River Basin (MRB) resources and biodiversity (e.g. Adamson et al. 2009, Nguyen & Sunnucks 2012). Advanced genomics has improved our ability to apply population genetics for these purposes (Allendorf et al. 2010, Seeb et al. 2011). The Mekong Delta (MD) of Vietnam harbors a very high diversity of species and highly valuable fisheries resources (Campbell 2012). However, climate change, numerous dams planned for the MRB, engineering for hydrological control, and increased agriculture, human population and development pose significant challenges for the maintenance of the wealth of biodiversity and resources of the MD (Baran & Guerin 2012, Campbell 2012, Grumbine et al. 2012, Kokonen 2008, Poulsen et al. 2004, Stone 2011). This proposed PEER project will provide valuable information about the connectivity of aquatic populations within and across the mouth of the MD that can be used for improved environmental governance such as delineating management zones and formulating strategies for biodiversity conservation. Furthermore, one species to be studied is considered Near Threatened on the International Union for Conservation of Nature (IUCN) Red List (IUCN 2012) and the population information gained in this study will be applicable to its conservation and biodiversity conservation in general in the MD. The U.S. collaborator manages an IUCN threatened species project and extending collaboration through this PEER project will engage additional interest in the MD.

An important development impact will be science and gender capacity building in Vietnam, which in turn will lead to improved capability to manage the biodiversity and resources of the MD. The Principal Investigator for this project is an early career woman professional having obtained her Ph.D. in 2010. She has undergone initial training in advanced genomics as part of two NSF projects managed by the U.S. collaborator for this PEER project. The U.S. collaborator is also dedicated to helping her further develop expertise in advanced genomics and apply this to biodiversity management. Therefore, this PEER project will further train and allow her to put in practice these new methods and apply them to the most pressing environmental concern in Vietnam: the threats to biodiversity and resources of the MD.

Remember to save regularly using the "Save as Draft" button at the bottom of the page. For further instructions on each question, please consult the program instructions.

III-Project Description

Please address each section of the proposal description concisely (within the character limit). If needed, you may also upload figures and/or tables as an annex at the end of this application. Please reference each figure in the text. Incomplete proposals and those not submitted in the required format will not be considered.

3.a) Background and rationale*

The extreme concentration of biodiversity and heavily exploited natural resources of the Mekong River (MR), and their exposure to changing hydrological conditions poses one of the greatest environmental challenges to Asia. The Mekong Delta (MD) further focuses biodiversity threat because of the dual impacts of reduced water flow from damming and increased incursion of seawater from climate change. Innovative application of advanced genetic methods can help sustainably manage this increasingly threatened ecosystem.

MR Basin faces increasing threats from hydropower development. It encompasses 28 endemic fishes of which 4 are known only from the MD (Campbell 2012). In addition, the fishery of the MR is one of the most productive in the world and supports livelihoods for millions (Poulsen et al. 2004). The MR is one of the few major rivers with substantial hydropower potential that has not yet been dammed through much of its length, although up to 88 new dams are planned by 2030 (Stone 2011, Baran & Guerin 2012). Based on what happened elsewhere in the region, e.g. a series of dams on the Yangtze River, these new dams will have major effects on biodiversity and fisheries. Changes in flow and sedimentation of the MR are predicted to have profound effects on the spawning and rearing zones for many exploited fishes, with substantial reduction in fisheries landings (Poulsen et al. 2004, Ziv et al. 2012). Sedimentation reduction from damming also profoundly influences productivity patterns as suspended sediments influence nutrient loads to all trophic levels and light penetration from turbidity. Reduced sedimentation will also diminish river bank replenishment and therefore result in erosion of agricultural and habitable land. This effect, coupled with projected increases in sea level from climate change will cause submersion of large areas of delta land.

Reduction of land in the MD will have profound effects on the economy of Vietnam. Engineering attempts to mitigate land loss and control hydrological conditions (Kakonen, 2008) will complicate efforts to manage living aquatic resources. This is complicated further by water quality impacts from growing human populations, a fast-growing economy, expanding agriculture, and changing salinity patterns from climate-change induced sea level increases. These impacts and hydrological changes from damming make it increasingly important to understand the dynamics of fish populations to make informed decisions on how best to maintain biodiversity and fisheries. Otherwise, gains from a growing economy and improved access to electricity from hydroelectric power may be offset by losses in aquatic food resources (Ziv et al. 2012).

Effective management of aquatic populations depends on an understanding of their population ecology. Direct observation of submerged living resources is very difficult at best, and therefore indirect inferences are used through examination of the basic biology of extracted specimens. Fortunately, population genetics provides a powerful means to better understand population ecology of fishes (Hauser & Seeb 2008). In addition, knowledge of fine-scale population genetic structure and patterns of connectivity are essential for conservation of genetic diversity and maintaining population viability, particularly for exploited species (Reed & Frankham 2003). Information on population substructure determines the scale of effective conservation action and stock identification for management. It also defines the scale at which populations experience local adaptation and therefore the ability to adapt to changing environments, particularly those due to climate change (Reed & Frankham 2003, Allendorf et al. 2010). The understanding of population substructure through genetics for improving fish management is being increasingly applied to small-scale riverine systems (e.g. Raeymaekers et al. 2009, Wellband et al. 2012), including the MR Basin (e.g. So et al. 2006, Nguyen & Sunnucks 2012). Thanks to advances from the human genome project, cutting edge genetic methods are now available and provide powerful tools that improve our ability to use genetics for management of resources (Allendorf et al. 2010, Seeb et al. 2011, Funk et al. 2012).

The purpose of this proposed research is to apply advanced genomics to understand population dynamics across the diverse hydrological conditions of the MD. To apply this to the freshwater, estuarine and marine extent of the MD we will examine fine-scale population structure of 3 representative species. This will enhance management of these resources and provide a basis for extending this to a wider array of species (Raeymaekers et al. 2009) in the MD. Another important purpose is for the PI to initiate a long-term genetic monitoring and research program focused on fishes, to better understand population parameters that will help manage and conserve the increasingly threatened biodiversity of the MD.

3.b) Prior experience and relevant capabilities of principal investigator*

Dr. Binh Thuy Dang has 15 years' experience working in molecular ecology applied to fisheries research. She has a Masters of Science in Marine Science under DANIDA scholarship at University of Aarhus, Denmark in 2001. She received a 'QUOTA' scholarship for her PhD degree at the University of Bergen, Norway (2006-2010). Dr. Binh is a senior researcher at the Institute for Biotechnology and Environment, Nha Trang University. Her research interests include evolution, phylogeny, phylogeography, biodiversity, population genetics and conservation of marine and aquatic organisms. She is the leader of Biodiversity and Conservation group and is responsible for international cooperation at the Institute for Biotechnology and Environment at Nha Trang University.

Dr. Binh is a long time contributor and now principle investigator to the National Gen Conservation Project titeled "Gen conservation of Vietnamese marine organism" (2004-2009). She is a member of Vietnamese Gen Conservation Network. Additionally, Dr. Binh is involved in several national and international projects such as: a) CARD project, ACIAR support "Increase the capacity on nutrient analysis in Vietnam" headed by the Faculty of Aquaculture, Nha Trang University; b) NUFU Project "Aquaculture and coastal management in Vietnam" headed by the Institute of Aquaculture Research Number 3, and c) Component 4, SRV2701 project "Environmental impact of Aquaculture activities to the issue of food safety of green mussels and aquatic snails in integrated farming systems" under NORAD framework, headed by Nha Trang University. Recently, her laboratory became involved in the CT – PIRE project (lead by Old Dominion University) working with biodiversity and conservation genetics in Vietnam. Through this collaboration, scientific staff at NTU and other Research Institutions in Nha Trang were trained in molecular techniques and bioinformatics. Dr. Binh also has a grant from the EU: "Parasite Risk Assessment with Integrated Tools in EU fish production value chains" (GA Number 312068) with responsibility for a case study in Vietnam.

Dr. Binh teaches courses in Evolution and Biodiversity. She is also involved in teaching of Bioinformatics for Bachelor student of Biotechnology. She created the exchange student Program between Jan Evangelista Purkyně University in Ústí nad Labem, Czech Republic and Institute for Biotechnology and Environment, Nha Trang University, and responsible for the course "Applied Biotechnology in Environmental Research" and "Marine Biodiversity" for Czech master students.

As a collaborator and PI of national and international projects, Dr. Binh has worked as supervisor of several students (five Masters and more than 15 bachelor students). Dr. Binh has also presented her research results in national and international conferences of biotechnology, biodiversity, fish health, aquaculture and mollusks. She has published in both national and international journals and has also been invited to peer review papers.

Scientific research on population genetics, genetic conservation and phylogeography in Vietnam is very limited. Dr. Binh is well-suited to conduct this research and is supported by a staff of highly qualified scientific researchers at the Institute of Biotechnology and Environment. She has a fully functional genetic laboratory with PCR capability. She also has an on-going collaboration with Old Dominion University and an NSF-supported project on population genetics of marine species in SE Asia. As part of this collaboration she attend an NSF Advanced Study Institute on the use of advanced genomics in biodiversity ecology in SE Asia. She is particularly interesting in the application of population genetic information to the conservation strategy of Vietnam's fisheries resources.

3.c) Project scope and objectives*

Scope

This project will use advanced genomics to examine the population ecology of three species representative of strictly freshwater species, an estuarine species and a marine species of the Mekong Delta region. The purpose is to understand the connectivity and substructure of these populations that will allow an evaluation of the influence of changing environmental conditions in and around the delta resulting from hydrological changes form damming projects upstream, climate change, and increased use of delta land for

human populations, agriculture and industry. The three species represent a range of potential changes that can occur to connectivity of populations north and south of the Mekong outflow, within the narrow estuarine influence of the Mekong at the mouth of the delta (Wolanski et al. 1996), and further upstream in mostly freshwater localized populations. This project is intended to initiate an active, long-term research program at Nha Trang University to monitor genetic structure of a wide range of species in the Mekong Delta region and therefore the scope will eventually extend well beyond this proposed project.

Objectives

1. Understand the population substructure of a typical sedentary freshwater Mekong River species that will likely be influenced by the myriad environmental changes occurring in the Mekong Delta.

2. Examine population connectivity and ecology of a mostly estuarine species to better understand the influence of salinity changes on biodiversity and fisheries in the Mekong Delta that are expected from reduced flow from damming and increased incursion of seawater from rising sea level due to climate change.

3. Understand population connectivity changes north and south of the Mekong outflow that will occur due to hydrological changes from damming and climate change.

4. Enhance capacity building of advanced genomics at Nha Trang University and its application to conservation genetics, biodiversity conservation, and resource management in the Mekong Delta region. The on-going collaboration with the NSF Partnerships for International Research and Education project has helped introduce these cutting edge genetic methods to the Principal Investigator's research program. Planned advanced genomics training through the NSF project and its application in this PEER project will combine to ensure effective integration of this new capacity into the research program at Nha Trang University.

5. Initiate an active long-term research program at Nha Trang University to monitor and investigate a wide range of aquatic and marine species in the region of the Mekong Delta. Present research activity of the Principal Investigator's lab is focused around central Vietnam and there is an intense interest to expand work to the Mekong Delta where numerous environmental threats are concentrated and serve as a comparative site for similar threats localized near Nha Trang. Furthermore, it is the aim of the PI to eventually gather demographic and other population ecology parameters of target species to more fully utilize the genetic connectivity data for conservation purposes (Lowe & Allendorf 2010).

3.d) Research plan*

The overall research plan will consist of collecting population size samples of three species (see 3c objectives) of fishes across a range of delta sites, develop a robust set of genetic markers using advanced genotypinc methods, and analyze population genetic structure to establish connectivity and substructure of populations. There are three target species that represent different ecozones of the Mekong Delta and correspond to the first three objectives outlined above:

1) The smallscale croaker, Boesemania microlepis, is a non-migratory species important to fisheries that is likely to have localized populations in the Mekong River (Poulsen et al. 2004) and therefore an ideal candidate to investigate population substructure of a freshwater fish across the Mekong Delta. Advanced genomics will allow greater capability to estimate and monitor effective population sizes and identification of management units (Allendorf et al. 2010) and this species will serve as an exemplar for freshwater species in the region. Furthermore, the smallscale croaker is considered Near Threatened on the IUCN Red List of Threatened species (IUCN 2012) and because of increased threat across its range is likely to become a threatened species unless active conservation action is put in place (IUCN 2012). This study aims to provide information that will directly contribute genetic approaches to conservation and recovery of this species and potentially other threatened species in the region.

2) The sabertooth thryssa anchovy, Lycothrissa crocodilus is a mostly estuarine species that is important in fisheries in the Mekong Delta (Hall 2010). It has a set spawning season that could be influenced by a variety of environmental factors, including climate change (Poulsen et al. 2004). The extent of estuarine zone of the Mekong Delta is limited to around 45 km from the mouth of its various outflows (Wolanski et al. 1996) and this extent will likely change over the coming years. The population of this estuarine anchovy could be either positively or negatively influenced by these changes and consequently could become more or less important in fisheries production of the region. Understanding the genetic structure of this species and its potential to adapt to changing and potentially expanding habitats could be key to helping maintain vital fisheries resources and estuarine biodiversity of the Mekong Delta.

3) Preliminary data from a U.S. National Science Foundation Partnerships for International Research and Education project indicates that population structure occurs along the coast of Vietnam in at least one commercial fish species, the redspot emperor snapper, Lethrinus lentjan. This component of the study will confirm finer population substructure and connectivity of this species around the Mekong Delta to better understand the extent of the influence of the outflow of the Mekong River on biodiversity and fisheries of the region and potential changes that may occur from expected environmental changes.

The freshwater and estuarine species will be collected within Vietnam at 14 sites along the Hau and Tien Rivers and their downstream branches (Fig. 1) with the freshwater species collected primarily in the upper reaches of these rivers and the estuarine species collected in the middle and lower reaches of the delta. For outgroup population comparison, these two species will also be collected north of Ho Chi Minh City on the Sai Gon River and the Da Rang River in Phu Yen Province, central Vietnam. Local fishermen will be contacted for directed collection effort at localities that can be georeferenced. Planned collection sites outnumber final population numbers to be analyzed for genetic variation because success for all species is not ensured at all sites. The marine species, Lethrinus lentjan, has already been collected from Phu Quoc island and at Nha Trang and for purpose of this study will also be collected at four additional sites south and north of the Mekong outflow (Fig. 1 inset). About 50 specimens of each species will be collected at each of their respective sites and tissues stored in 95% ethanol. Voucher specimens and photographs will be stored at NTU. A total of 16 localities will be selected among all collection sites for population analysis. These will represent the 5 of the most widespread successful collection sites within the Mekong Delta and 2 outgroup sites each for the freshwater and estuarine species (7 localities total for each of the freshwater and estuarine species). For the marine species, the 4 most widespread sites along the coast of Vietnam north and south of the Mekong Delta will be selected.

The advanced genomic method that will be followed in this research plan is called 2b-Restriction-site Associated DNA (2b-RAD) that can simultaneously discover and genotype Single Nucleotide Polymorphisms to infer population structure (Hohenlohe et al. 2010, Wang et al. 2012). It is rapid and cost-effective and laboratory preparations using this method have been successful in the NSF PIRE project. The proposed PI for this PEER project has also received preliminary training for these advanced genomics methods during the NSF Pan-Pacific Advanced Study Institute held in the Philippines in 2012. Additional training will be carried out as part of the NSF PIRE project in early 2013. The 2b-RAD preparation protocol of Wang et al. (2012) will be conducted at NTU and sequencing done at core facilities with the Illumina HiSeq platform such as the University of Texas or University of California at Berkley. High quality reads from raw reads will be obtained through stringency filters and aligned for a minimum of 20x coverage using scripts. Additional filters will screen ambiguities before scoring homozygous or heterozygous positions. SNP data will be used to determine population substructure and directionality of gene flow between sampling sites (Seeb et al. 2011).

3.e) Training and outreach plan*

The project will support the training of Masters and Doctoral graduate students and advance the existing knowledge of the junior and senior researchers. The project members belong to the Institute for Biotechnology and Environment (IBE) at the University of Nha Trang. Training will also be extended to interested undergraduates and additional researchers outside the IBE from Nha Trang University. Training will include a) learning techniques for field sampling including identification of fishes of the Mekong River and methods specific for molecular genetics applications; b) tissue and specimen preservation and

preparation for subsequent laboratory work; c) basic and advanced molecular genetics and genomics laboratory techniques (sequentially over the two year study); d) introduction and extensive exposure to genetics software and analytical tools including bioinformatics pipelines used to analyze next generation sequencing data; and e) guidance and expert support in the preparation of manuscripts and presentations to be given at conferences and meetings with management agencies and other stakeholders. The US collaborator, through his existing NSF-supported ctPIRE project, will contribute in all phases of the training when possible. An advanced genomics training is planned for 2013 through the NSF PIRE project and will include collaborators with expertise in various aspects of next generation sequencing and bioinformatics.

In addition to building the scientific capacity of Vietnam's academic and research institutes through the training students and researchers, others who would benefit from this project would include the broader communities of students, laypeople, and staff at IBE, and regional and national institutes of higher education, resource management, and administration through the sharing and presentation of results. Given the targeted commercial species in the project, fishing industry and resource and conservation managers in Vietnam would also benefit from this study. Results of the project will be published and these results will be disseminated in Vietnam through participation in national meetings, particularly those directly related to biodiversity and resource management of the Mekong Delta.

3.f) Role and responsibilities of U.S. collaborator (if any)

The role of the U.S. collaborator, Dr. Kent Carpenter, will be to aid in continued training in advanced genomics, help in collection and identification of fishes, facilitate completion of sequencing tasks, and integration of scientific results with the NSF PIRE project. Dr. Carpenter has over 35 years of international research experience, primarily in SE Asia. He is the PI of both the NSF PIRE project and a recent NSF project "Pan-Pacific Advanced Study Institute, Advanced Genomic Applications to Marine Science and Resource Management in Southeast Asia." As a result of the NSF-supported planning visit "Broadening PIRE Success in Southeast Asia to Test Hypotheses of the Origins of Coral Triangle and Sunda Shelf Marine Biodiversity and Build Collaboration in Vietnam and Thailand," the NSF PIRE project will continue to work in Vietnam through late 2014. Dr. Carpenter will also continue to seek funding for research in Vietnam well beyond 2014. As part of this PIRE project, Dr. Carpenter will help organize and take part in a joint research and training sessions using advanced genomics in Vietnam in 2013 and 2014. This activity will ensure the proposed PEER project is integrated into a project that is synergistic with and complements more broad research and development goals. It will also ensure that the newest methods of advanced genomics are integrated into the PEER project. Dr. Carpenter has collaborators in the rapidly developing field of advanced genomics using next generation sequencing and will be bringing them to Vietnam for the joint U.S.-Vietnam training sessions. Dr. Carpenter is also an expert systematic ichthyologist with primary interests in SE Asian fishes. He served for many years as technical editor and contributor for numerous Food and Agriculture Organization fisheries species identification guides, including the field guide "Fishes of the Cambodian Mekong" (Rainboth, 1996). He will serve as taxonomic and fish biology consultant for the PEER project, particularly during field collection activities to ensure correct identification of samples. Dr. Carpenter will also help facilitate sequencing and laboratory activities in Vietnam by helping with access to sequencing supplies and facilities. He has an active research laboratory with 2 Post-doctoral associates, 3 Ph.D students, and 4 Master's students, all of whom are working on projects related to SE Asian biota. His laboratory also typically has 5 undergraduate interns actively working in international projects. Dr. Carpenter will continue to integrate the research of his laboratory into research and development projects in Vietnam to help forge continued collaborative ties with members of the PEER and PIRE projects.

Remember to save regularly using the "Save as Draft" button at the bottom of the page. For further instructions on each question, please consult the program instructions.

3.g) Expected development outcomes*

Vietnam is one of the most biodiverse countries in the world. However, in recent decades, indiscriminate fishing and poor resources management have led to the severe losses in many of Vietnam's animal populations. The Mekong Delta is a major agricultural and fisheries production zone in Vietnam. Increasing human demand for natural resources, particularly land for agriculture and aquaculture, coupled with

agricultural intensification, has significantly reduced the extent of natural and semi-natural habitats in the delta (Campell, 2012). At a minimum, 260 species of fish inhabit the Mekong Delta (Le Dien Duc 1989), including 28 Mekong-endemic fishes of which four are known only from the Mekong Delta.

Presently, data needed to make more informed management decisions, particularly regarding genetics, are very limited. One aim of this project is to generate the basic research, apply advanced genomics to understand the population dynamics of selected fish across the diverse hydrological conditions of the Mekong Delta, specifically for regional, national, and international efforts and initiatives in conservation and resource management.

Since the early 1960s, in order to prevent biodiversity degradation, Vietnamese Government have built construction, issued a number of policy documents and legislation related to biodiversity conservation. From there so far, the legal and institutional reforms to continue to be made with the advent of several laws relating to conservation and biodiversity, including: Law of Forest Protection and Development, 1991 (as amended, added to the 2004); Land Law 1993 (amended and supplemented in 1998 and in 2003); Environmental Protection Law 1993 (the amended and supplemented in 2005); Fisheries Law in 2003. Recently, the Biodiversity Law approved by the National Assembly through November 13, 2008 (No. 20/2008 /QH12) and takes effect July 1 in 2009.

Vietnam's signing of the Convention on Biological Diversity (CBD) in 1993, ratified in 1994, committed Vietnam to increase its protected area coverage to two million hectares by the year 2000. Within the scope of the CBD, Vietnam formulated a national Biodiversity Action Plan (BAP), ratified under Resolution No. 845/TTg of the Prime Minister, dated 22 December 1995. Up to date, Viet Nam has signed several International agreements as following Convention on Wetlands (referred to as Ramsar Convention) 1989; Convention on Biological Diversity (CBD) 1992 and Cartagena Protocol on Biosafety 2004.

This project's aim is also in line with efforts by international organizations, such as USAID whose country interest for Vietnam includes addressing environmental issues, specifically the sharing of innovative technologies and methodologies for biodiversity conservation and assessing the anticipated impacts of climate change on Vietnam's naturalresources.

Additionally, scientists at the graduate and undergraduate level trained in applying advanced genotyping to the assessment of fine-scale population connectivity will be important in capacity building at Nha Trang University. They will in turn, help other scientists and strengthen the scientific foundation of the country to meet future environmental and conservation challenges. This with also nurture and promote international scientific exchanges between Vietnamese students, researchers and faculty, and counterparts in neighboring and regional countries also investing in biodiversity conservation and management.

3.h) Data sharing and dissemination plan*

The results of the research projects will be summarized and published in national and international peer-reviewed journals, and sequence and genetic data will be shared broadly through public databases. To ensure local accessibility of the project's discoveries, the following Vietnamese-language journals will be targeted; Journal of Biotechnology, Journal of Biology, Journal of Agriculture and Rural Development, Journal of Fisheries Science and Technology, whereas other results will be presented in international journals.

Project members will also regularly participate in national scientific meetings [National Biotechnology Conference, national Aquaculture Conference, and Biodiversity Conference] and in one international meeting at the conclusion of the study. As data becomes available and during the third year of research, results will be shared with conservation and resource management stakeholders at the local and national levels.

All publications and presentations at conferences will be developed in cooperation between the Institute for Biotechnology and the Environment, Oceanography Institute, and Old Dominion University collaborators.

3.i) Timeline

Provide a list of major project activities and milestones along with the estimated time required to complete each. (If your timeline is in a spreadsheet or graphical format, you may upload it instead)

Planing PEER.xls

3.j) Supplemental information

If your project involves human subjects, animals, biohazards, or endangered species, please describe plans for addressing these aspects, including minimizing potential risks. Institutional review board approvals or plans to obtain such approvals should be described

All test animals are commercial fishery species that are regularly caught and sold in the Mekong Delta. There are not national regulations for the collection and genotyping of these types of specimens in Vietnam.

3.k) Budget request justification*

Explanations for requested funding are as follow:

a) Travel costs – Funds are requested to cover the cost of transportation, accommodations, and per diem required for field sampling. Agreements will be made with fisherman; therefore, funds for buying specimens are requested. Funds are also requested for travel to ODU for molecular and bioinformatics training for the PI and a PhD student. Additional travel funds are requested to allow project members to present results at national and international conferences.

b) Materials and supplies – Funds are requested for chemicals, reagents and consumable supplies needed for necessary pre-genotyping reactions, such as DNA extraction, PCR materials and reagents, enzymes, Illumina barcodes etc. Cost $20 per individual.

c) Sequencing costs – About $35 per individual at 20x coverage on an Illumina HiSeq.

d) Shipping – Funds are requested for shipping samples, reagents, and sequencing products between Nha Trang and suppliers/analysis facilities.

e) Graduate student and researcher stipends – Funding requested covers the stipends/salary of project members and graduate students. Presently, extensive time and effort teaching and providing analytical services are required for young lecturers and reserachers to receive their yearly salary. Stipends for project members will help support them so that they can focus on research activities rather than being paid for other tasks. Stipends will also help support the cost of living and study fees of graduate students involved.

f) Principle investigator salary – Research time for the PI is allocated according to extramural funding. Without salary compensation for research included in research projects, her work time cannot be dedicated to research but instead will be allocated to other faculty tasks such as teaching and administration. Salary is included in the budget as a necessary means for her to allocate time to research.

g) Equipment and Facilities – Funds are requested for a computer to store the large amounts of genetic data returned from high-throughput sequencing and to run analyses. Costs also include buying necessary software. Additional funding is requested for publishing fees in national and international publications.

h) Education and training: The PI will be trained in the basics of preparation of specimens for 2b-RAD genotyping by PIRE project personnel early in the project. During the project, the PI and a PhD student will be sent to the molecular lab at Old Dominion University to receive advanced bioinformatics and genotyping instructions to handle analysis of 2b-RAD data and to develop additional advanced genotyping skills in other technologies.

i) Administrative costs/Indirect costs – About 2% of the project budget must go to the Institution system for administrative support, lab maintenance, equipments maintenance, and general administration. Other indirect costs include printing, copying, paper, telephone, fax, and printing of posters.

3.l) Travel details*

Travel funds requested are for a) field sampling, b) participation and dissemination of findings at scientific meetings, and c) participation in training at the molecular laboratory at Old Dominion University. Requested funds for travel are identical for all two years of the project, with the inclusion of international travel during the first and final year.

a) Field sampling will occur twice a year at localities along the three rivers. Each sampling trip will include 6 project members (2 senior researchers, 2 junior researchers, 2 graduate students) per trip. Field sampling trips are anticipated to take 4 to 6 days depending on the distance from Nha Trang and logistics in reaching each site.

b) Participation in scientific meetings is included to both increase the dissemination of findings and provide project members with exposure to intellectual exchanges and networking. Each year three project members (principal investigator, 1 junior/senior researcher, 1 graduate student) will attend the annual (Biotechnology Conferences) in Hanoi or HCMC. In the final year of the project, two project members (principal investigator, 1 researcher or grad student) will participate in the International conference of biodiversity conservation.

c) Learning advanced molecular techniques and analysis. The PI and a PhD student will participate in training at the Old Dominion University molecular lab. Training is expected to run for 1 month.

3.m) Other funding and other collaborating institutions (If any)

[Unanswered]

3.n) Budget*

Provide an itemized budget for the project using the budget form provided. Instructions on the budget are included in the excel form

budget PEER.xls

Attachments

Annex (if any)

If necessary, please include your figures and diagrams in a single document annex and refer to them in your project description (for example Figure 1 in Annex, etc...). Please do not exceed five figures/tables combined and do not include additional project narrative to this document.

Literature Cited - Figure 1.pdf

Curricula vitae (Developing Country PI)*

Please attach the principal investigator's brief CV, which should be no more than two pages in length and include citations for no more than five to ten recent relevant publications or patents (you can refer to a sample CV if needed be). If the project includes more than one developing country institution, please also include a CV for the key project participant at each institution. Please do not submit electronic copies of publications or other background materials, as they will not be forwarded to reviewers. All the CVs must be submitted in one single file.

CV_-_PEER_project-_4.pdf

Curriculum vitae (U.S. Partner)*

Please attach your U.S. partner's brief CV, which should be no more than two pages in length and include citations for no more than five to ten recent relevant publications or patents.Please do not submit electronic copies of publications or other background materials, as they will not be forwarded to reviewers.

BioSketchCarpenterPEERprojectVietnam.pdf

NSF award abstract*

Please attach a copy of the abstract of your U.S. partner's NSF award. You can access it through the NSF website award database .

PIREAwardAbstract.pdf

Letter of support from the US collaborator*

The letter must be written on official institutional letterhead and must list the title and award number of the U.S. collaborator's active NSF grant, provide details on how the proposed project relates to this NSF grant, and explain the U.S. collaborator's expected role in the project. The letter must be signed by the U.S. collaborator. PEER funds may not be used to cover the U.S. partner's salary, travel, or other expenses. In consenting to serve as partners on PEER Science proposals, U.S. partners must clearly understand that they cannot receive PEER funds and that, while they are encouraged to seek supplemental funds from NSF if necessary, such supplemental support cannot be guaranteed.

LetterOfSupportPEERVietnam2012.pdf

Letter of support from an official at the principal investigator's institution *

The letter should be from a person who is legally authorized to make commitments on the instution's behalf. If your project involves more than one developing country instution, please submit a separate support letter from each. The letter must be written on official institutional letterhead and must include the following: 1. Confirmation that the institution supports the participation of its staff in the proposed project, would be willing to receive and administer any grant funds awarded, and would be permitted under local regulations to receive grant funds from a foreign sponsor 2. Description of the institution's structures, practices for project management and financial overisght, as well as description of the process by which the institution could receive grant funds 3. Brief description of resources made available by the instutions to facilitate the project, whether in cash or in kind. 4. Examples of other grants your institution received from foreign sponsors (if any).

letter of intent.jpg

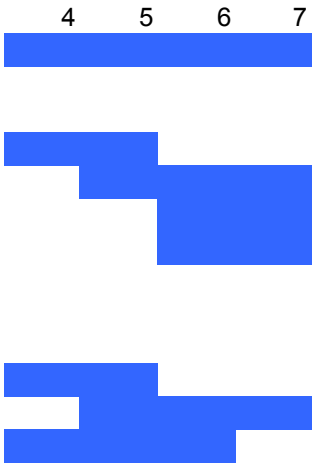
Once you have filled out all the sections of the application and uploaded all the required documents, you can then submit your application by clicking the "Submit Form" button at the bottom of the page. Please consult the PEER Science website for further information. If you have any additional questions regarding the PEER Science program, please contact us at peer@nas.edu.

File Attachment Summary

Applicant File Uploads

- Planing PEER.xls
- budget PEER.xls
- Literature Cited - Figure 1.pdf
- CV_-_PEER_project-_4.pdf
- BioSketchCarpenterPEERprojectVietnam.pdf
- PIREAwardAbstract.pdf
- LetterOfSupportPEERVietnam2012.pdf
- letter of intent.jpg

Year of activity	Month
Year 1 (Aug. 2013 - July 2014)	8 9 10 11 12 1 2 3
Sampling and field work	
Specimen voucher/preparation	
2b-RAD sequencing run	
Alignment and SNP RAD tag discovery	
Data analysis	
Writing progress report	
National conference	
Year 2 (Aug. 2014 - July 2015)	
Sampling and field work	
Further genotyping	
Data analysis	
Writing final report	
National/International conference & training	


4
5
6
7

Note: List all amounts in U.S. dollars only		**Year 1**	**Year 2 (if requested)**	**Year 3 (if requested)**
Travel	1. Domestic Travel	$ 6,000.00	$ 6,000.00	
	2. Per Diem, Domestic	$ 2,000.00	$ 2,000.00	
	3 International Travel	$ 2,000.00	$ 4,000.00	
	4. Per Diem, International	$ 2,000.00	$ 1,000.00	
	5. Accommodation international	$ 1,500.00	$ 500.00	
Travel Costs Total (A)		**$ 13,500.00**	**$ 13,500.00**	**$ -**
Equipment	1. Instruments			
	2. Materials and Supplies	$ 10,500.00	$ 8,000.00	
Equipment Costs Total (B)		**$ 10,500.00**	**$ 8,000.00**	**$ -**
Other Direct Costs	1. Computer Services	$ 1,000.00		
	2. Publication Costs+ conference fee		$ 3,000.00	
	3. Workshops and conferences			
	4. Sequencing Illumini HiSeq	$ 21,500.00	$ 10,000.00	
	5. Other ((software, books. Shipping, printing, copy cost, telephone, fax)	$ 2,000.00	$ 2,000.00	
Other Direct Costs Total (C)		**$ 24,500.00**	**$ 15,000.00**	**$ -**
Salaries and Stipends (list each position on separate line and indicate % of time to be spent – add more lines if needed)	PI	$ 4,800.00	$ 4,800.00	
	Project secrectary	$ 2,700.00	$ 2,700.00	
	Senior researcher (2)	$ 2,000.00	$ 2,000.00	
	Juniro researcher	$ 800.00	$ 800.00	
	PhD student (junior researcher)	$ 4,800.00	$ 4,800.00	
	Graduate student (3 masters)	$ 1,200.00	$ 1,200.00	
Labor Costs Total (D)		**$ 16,300.00**	**$ 16,300.00**	**$ -**
Institutional Indirect Costs (if requested, full justification must be provided) (E)		**$ 1,000.00**	**$ 1,400.00**	
Grand Total Project Costs (F) (A+B+C+D+E)		**$ 65,800.00**	**$ 54,200.00**	**$ -**

Project Total
$ 12,000.00
$ 4,000.00
$ 6,000.00
$ 3,000.00
$ 2,000.00
$ 27,000.00
$ -
$ 18,500.00
$ 18,500.00
$ 1,000.00
$ 3,000.00
$ -
$ 31,500.00 $ 4,000.00
$ 39,500.00
$ 32,600.00
$ 2,400.00
$ 120,000.00

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Adamson EAS, Hurwood DA, Bake AM, Mather PB. 2009. Population subdivision in Siamese mud carp *Henicorhynchus siamensis* in the Mekong River basin: implications for management**.** *Journal of Fish Biology.* 75: 1371–1392.

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Hohenlohe, PA, Bassham S, Etter PD, Stiffler N, Johnson EA, Cresko WA. 2010. Population Genomics of Parallel Adaptation in Threespine Stickleback using Sequenced RAD Tags. *PLoS Genetics*. www.plosgenetics.org 6 (2) e1000862.

Hollatz C, Vilaca ST, Redondo RAF, Marmontel MC, Baker S, Santos F. 2011. The Amazon River system as an ecological barrier driving genetic differentiation of the pink dolphin (*Inia geoffrensis*). *Biological Journal of the Linnean Society*. 102: 812–827

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Lukosche V, Osterhage JL , Karns DR, Murphy JC, Voris HK. 2012. Phylogeography of the Mekong mud snake (*Enhydris subtaeniata*): the biogeographic importance of dynamic river drainages and fluctuating sea levels for semiaquatic taxa in Indochina. *Ecology and Evolution*. Open access. doi: 10.1002/ece3.29

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Poulsen AF, Hortle KG, Valbo-Jorgensen J, Chan S, Chhuon CK, Viravong S, Bouakhamvongsa K, Suntornratana U, Yoorong N, Nguyen TT, Tran BQ. 2004. Distribution and ecology of some important riverine fish species of the Mekong River Basin. MRC Technical Paper. Mekong River Commission, Phnom Penh

Raeymaekers JAM, Maes GE, Geldof S, Hontis I, Nackaerts K, Volckaert FAM. 2008. Modeling genetic connectivity in sticklebacks as a guideline for river restoration. *Evolutionary Applications*, 1: 475–488.

Raeymaekers JAM, Rayemaekers D, Koizumi, I, Geldorf S, Volckaert FAM. 2009. Guidelines for restoring connectivity around water mills: a population genetic approach to the management of riverine fish. *Journal of Applied Ecology*. 46: 562-571.

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Wolanski E, Nguyen NH, Le TD, Nguyen HN, Nguyen NT. 1996. Fine-sediment Dynamics in the Mekong River Estuary, Vietnam. *Estuarine, Coastal and Shelf Science.* 43, 565–582

Ziv G, Baran E, So Nam, Rodríguez-Iturbe I, Levin AS. 2012. Trading-off fish biodiversity, food security, and hydropower in the Mekong River Basin. *PNAS*. 109(15): 5609-5614.

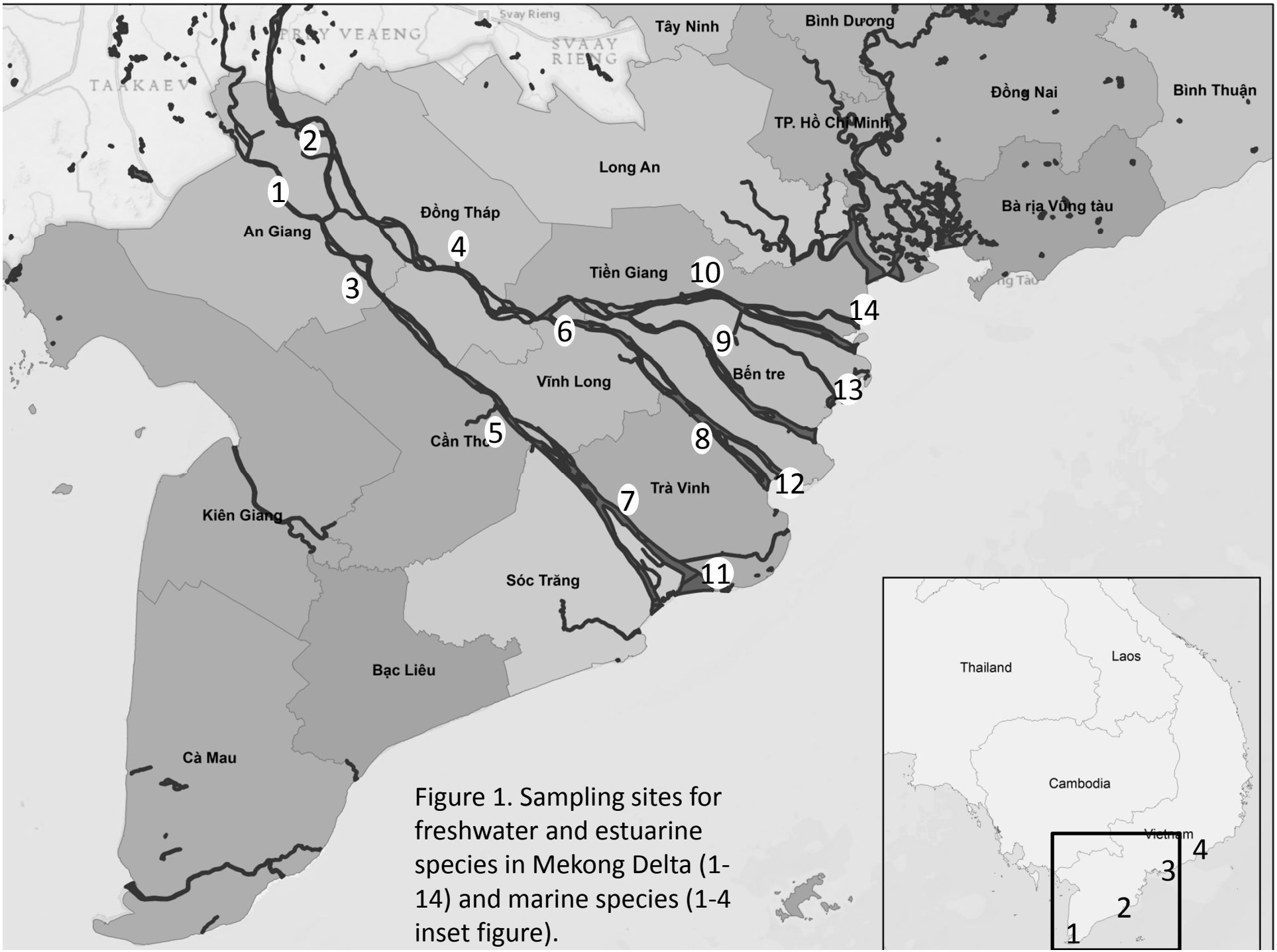

Figure 1. Sampling sites for freshwater and estuarine species in Mekong Delta (1-14) and marine species (1-4 inset figure).

CURRICULUM VITAE

1. Personal details

1	Full name	**DANG, BINH THUY**	Birth date	22 February 1969	Sex: M ☐; F ☑
	Academic title	Ph.D	Position/ title		Researcher
2	Institution & address	Institute for Biotechnology and Environment – Nha Trang University.			
	02 Nguyen Dinh Chieu Street, Nha Trang City, Khanh Hoa Province				
	Department/ division/ faculty	Department of Research and Development			
3	Office tel.	0583 832075	Mobile phone No.	0904135750	
	Fax	0583 832075	E-mail	binhdangthuy@gmail.com	

2. Qualifications:

Years	Academic institutions	Major/ Specialty	Academic degree
1989 – 1992	Da Lat University	Biology	BSc
1999 – 2001	University of Aarhus Denmark	Marine science	MSc
2006 – 2010	University of Bergen, Norway	Marine Biodiversity	Ph.D

3. Professional experience:

Years	Institution	Professional address	Position
1993 – present	Nha Trang University	02 Nguyen Dinh Chieu street, Nha Trang city	Researcher/lecturer
2010 - present	Nha Trang University	02 Nguyen Dinh Chieu street, Nha Trang city	Team leader of International relationships Team leader of Biodiversity and Conservation Team leader of exchange student program with Czech Republic (including teaching)
2012 - present	Nha Trang University	02 Nguyen Dinh Chieu street, Nha Trang city	Vice Director of Institute for Biotechnology and Environment

4. Language (rating: A- Poor/ deficient; B- Fair; C- Sufficient; D- Fluent)

Language	Reading	Writing	Speaking
English	D	D	D
Russian	B	B	B

5. Publications

Dang B.T., **Thu, N.T.A,** Anh, L.T.M. Molecular phylogeny of giant clams (*Tridacna* spp.) in the coastal regions of Southern and Central of Vietnam. Journal of Argiculture and Rural Development. 10/2012.

Dang, B.T, Khuc, T.A., Nguyen. T.T.H. 2012. Identification of cone snail (*Conus* spp.) In the coastal central Southern Vietnam based on morophologic And gennetic chacracters*.* Journal of Fisheries Science and Technology. 2/2012. 37-41.

Dang, B.T. Ng, D.N., Dao, T.N. 2012. Feeding mode of cone snail (*Conu*s spp.) and phylogenetic relationships, Journal of Fisheries Science and Technology. 3/2012. 9-13.

Đang, B.T, Ngo Đ. N.., Vu, Q.D.H. 2011. Population genetics of three spot seahorse (*Hippocampus trimaculatus*) from the south central coast of Vietnam. Vietnam Journal of Biotechnology. Special Issue.

Dang,B.T, Bristow G. A, Vu, Q.D.H. 2012. Phylogenetic relationships of monogenea (Monogenea: Platyhelminthes) found on grouper (Epinephelus spp. And *Plectropomus leopardus*) at Khánh Hòa Provinece, Vietnam – Journal of Argiculture and Rural Devekopment (No 5/2012).

Dang, B.T, Le, H.T.T, Truong, T.T.T, Nguyen, T.N.T 2011. The population genetics of *Conus textile* linnaeus, 1758 from the Southern central coast of Vietnam. Journal of Fisheries Science and Technology. 4/2011. 39-44.

Pham, T.T., **Đang, B.T**., Trưuong, T.T.T; Ngo, Đ.N. 2011. Molecular phylogeny of venomous cone snails *Conus* spp. In the coastal regions of southern central of Vietnam. Journal of Fisheries Science and Technology. 3.2011.

Đang, B.T *,* Bui, V.K., Nguyen, T.T.N. 2011. Distribution of cone snail (*Conus* spp) at Van phong bay, Khanh hoa. Journal of Fisheries Science and Technology. 3.2011.

Đang, B.T, Ngo Đ. N.. 2010. Genetic diversity of black tiger shrimp *(Penaeus monodon* Fabricius 1798) at the center and southern parts of vietnam. Journal of Fisheries Science and Technology. 1/2011.

Nguyễn, V.H., **Đặng, B.T.** 2010. Study the genetic population of Leopard coral grouper (*Plectropomus leopardus*) in Vietnamese coastal water using the cytochrom b of mitochondrial DNA (Cyt b mtDNA). Journal of Fisheries Science and Technology. 3/2010. 100-108

Projects involved:

CARD project, ACIAR support "*Increase the capacity on nutrient analysis in Vietnam." Leaded by Faculty of Aquacultur*e, Nha Trang University. (2000 – 2004)

NUFU Project "*Aquaculture and coastal management in Vietnam*". Leaded by Institute of Aquaculture Research Number 3 (2006- 2011).

Component 4, SRV2701 project "*Environmental impact of Aquaculture activities to the issue of food safety of green mussels and aquatic snails in integrated farming systems*" under NORAD framework, leaded by Nha Trang University. (2004-2009).

National Gen Conservation Project titeled "*Gen conservation of Vietnamese marine organism*" – collaborator (2004-2009).and PI (2010 – 2012).

CT–PIRE (CORAL TRIANGLE PIRE PROJECT) lead by Old Dominion University, 2010 - 2012

Parasite Risk Assessment with Integrated Tools in EU fish production value chains (GA Number 312068). EU funding. Coordinator of case study in Vietnam (2012 – 2015).

Kent E. Carpenter, Professor, Biological Sciences, Old Dominion University, Norfolk, VA 23529; 757-683-4197; kcarpent@odu.edu

Professional Preparation

B.S. Biology. Marine Biology Major, Biological Sciences, Florida Institute of Technology (FIT), Melbourne, Florida, 6/75, graduated with High Honors (Magna Cum Laude).

Ph.D. Zoology. Ichthyology Major, Department of Zoology, University of Hawaii, Honolulu, 12/85 (4.0 GPA). Dissertation: Taxonomy and phenetic, cladistic, and evolutionary classifications of fusilier fishes (Percoidei: Caesionidae)

Postdoctoral Institution: Hawaii Institute of Marine Biology. Area: Estuarine Ecology.

Appointments

Professor, Department of Biological Sciences, Old Dominion University, Norfolk, 1/96-present. (Associate Professor, 1/96-6/05).

Manager, Marine Biodiversity Unit (Global Marine Species Assessment), Species Programme, International Union for Conservation of Nature, 1/2006-present.

Senior Fishery Resources Officer, Program manager, Species Identification and Data Program, Marine Resources Service, Fishery Resources and Environment Division, Food and Agriculture Organization of the United Nations, Rome, Italy, 1/91 - 1/96.

Associate Research Scientist, Applied Marine Research Laboratory, Old Dominion University, Norfolk, Virginia, U.S.A., 10/90 - 1/91.

Associate Research Scientist, Marine Biology Section, Mariculture and Fisheries Department, Kuwait Institute for Scientific Research, Kuwait, 11/87 - 8/90.

Post-Doctoral Fellow, Hawaii Institute of Marine Biology, University of Hawaii; **Research Associate**, USAID supported Collaborative Research Support Program of Pond Dynamics/Aquaculture; **Visiting Assistant Professor**, College of Fisheries, University of the Philippines in the Visayas, 7/85 - 10/87.

Teaching Assistant, Vertebrate Zoology, Department of Zoology, University of Hawaii, Honolulu, 1/85 - 6/85.

Environmental Scientist, Coral Reef Ecology, Field Surveys, Data Base Management and Analysis, Saudi Arabia Honeywell Tetra Tech Inc., Dhaharan, Saudi Arabia, 3 - 12/82.

Curatorial Assistant, Division of Ichthyology, B.P. Bishop Museum, Hawaii, 12/78 - 7/79.

U.S. Peace Corps Volunteer, Philippines, **Project Leader**, Coral Reef Research, Bureau of Fisheries and Aquatic Resources, 7/76 - 11/78.

Publications most related to proposal

Ackiss, A.S., S. Pardede, E.D. Crandall, Ambariyanto, M.C.A. Ablan-Lagman, N.Romena, P.H. Barber, K.E. Carpenter. 2013 (In Press). Pronounced genetic structure in a highly mobile coral reef fish, Caesio cuning, in the Coral Triangle. *Marine Ecology Progress Series*.

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Carpenter, K. E., A. Muhammad, G. Aeby, R.B. Aronson, S. Banks, et al. 2008. One third of reef building corals face extinction from climate change and local impacts. *Science*. 321: 560-563.

Collette, B.B., K.E. Carpenter, B.A. Polidoro, M.J. Juan-Jordá, A. Boustany, et al. 2011. High Value and Long Life—Double Jeopardy for Tunas and Billfishes. Science. 333, 15 July 2011: 291-292.

Other research publications:

Carpenter, K.E and V.G. Springer (2005,). The center of the center of marine shorefish biodiversity: the Philippine Islands. *Environmental Biology of Fishes.* 72: 467-480.

Nañola C.L. Jr., P.M. Aliño, and K.E. Carpenter. 2010. Exploitation-related reef fish species richness depletion in the epicenter of marine biodiversity. *Environmental Biology of Fishes*. 94: 405-420.Carpenter, K.E. and G. D. Johnson. 2002. A phylogeny of sparoid fishes (Perciformes: Percoidei) based on morphology. *Ichthyological Research*. 49: 114-127.

Sadovy de Mitcheson, Y., M.T. Craig, A.A. Bertoncini, K.E. Carpenter, W.W.L. Cheung, J.H. Choat, A.S. Cornish, S.T. Fennessy, B.P. Ferreira, P.C. Heemstra, Min Liu, R.F. Myers, D.A. Pollard, K.L. Rhodes, L.A. Rocha, B.C. Russell, M.A. Samoilys, J. Sanciango. 2012. Fishing groupers towards extinction: A global assessment of threats and extinction risk in a billion dollar fishery. *Fish and Fisheries*. DOI: 10.1111/j.1467-2979.2011.00455.x

Comeros-Raynal, M.T., J.H. Choat, B.A. Polidoro, K.D. Clements, R. Abesamis, M.T. Craig, M.E. Lazuardi, J. McIlwain, A. Muljadi, R.F. Myers, C.L. Nañola, Jr., S. Pardede, L.A. Rocha, B. Russell, J.C. Sanciangco, B. Stockwell, H. Harwell, K.E. Carpenter. 2012. The likelihood of extinction of iconic and dominant herbivores and detritivores of coral reefs: the parrotfishes and surgeonfishes. *PLoS One*. 7(7):e39825

Carpenter, K. E. 1977. Philippine coral reef fisheries resources. *Phil. J. Fish.* 15(1): 95-125.

Synergistic Activities

Senior editor, Food and Agriculture Organization of the United Nations marine species identification guides.

Global Marine Species Assessment Manager, International Union for Conservation of Nature, funded research at ODU 6/05-present.

Collaborators (not listed as Thesis Advisees): Paul Barber, University of California Los Angeles; Tim M. Berra, Ohio State University; John E. Graves, Virginia Institute of Marine Science; Julian M. Humphries, University of Texas Austin; Yukio Iwatsuki, University of Miyazaki; G. David Johnson, Smithsonian Institution; John A. Musik, Virginia Institute of Marine Science; Thomas M. Orrell, National Marine Fisheries Service; John R. Paxton, Australian Museum Sydney; John E. Randall, Bishop Museum; David L. Reed, Florida Museum of Natural History; William F. Smith-Vaniz, U.S. Geological Survey; Victor G. Springer, Smithsonian Institution; Mark W. Westneat, Field Museum of Natural History

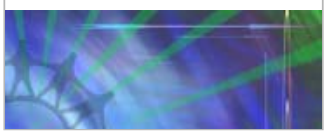
Graduate and Postdoctoral Advisors

Ph.D. dissertation chairman: James W. Archie, University California

Postdoctoral Advisor: Arlo W. Fast (retired), Hawaii Institute of Marine Biology

Post-doctoral and Thesis Advisees: Amanda Ackiss (ODU); Carolyn Ashby, (ODU); Eric Crandall, Southwest Fisheries Center, Clifornia; Mia Comeros-Raynal (ODU); Martin J. deGravelle, University of Louisiana; Adam Hanson (ODU); Andrew Hines (ODU); Karen Kowalski, Tidewater Community College; Alicia LoGalbo, Elizabeth River Project; Andrew Mahon, University Notre Dame; Jennifer Martin, Christopher Newport University; Jeremy Raynal (ODU); Jonnell Sanciangco (ODU) Millicent Sanciangco, (ODU); Matthew Semcheski, (ODU); Denise Sliter, City of Norfolk; Brian Stockwell (ODU); Thomas Wasaff, Alexandria City Department of Environment; Kimberly Wieber (ODU); Demian Willette (ODU).

Awards



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Award Abstract #0730256

PIRE: Origins of High Marine Biodiversity in the Indo-Malay-Philippine Archipelago: Transforming a Biodiversity Hotspot into a Research and Education Hotspot.

NSF Org:	OISE Office of International Science and Engineering
Initial Amendment Date:	September 5, 2007
Latest Amendment Date:	July 24, 2010
Award Number:	0730256
Award Instrument:	Continuing grant
Program Manager:	Nancy Sung OISE Office of International Science and Engineering O/D OFFICE OF THE DIRECTOR
Start Date:	September 1, 2007
Expires:	August 31, 2013 (Estimated)
Awarded Amount to Date:	$2,545,000.00
Investigator(s):	Kent Carpenter kcarpent@odu.edu (Principal Investigator) Patrick Halpin (Co-Principal Investigator) Paul Barber (Co-Principal Investigator)
Sponsor:	Old Dominion University Research Foundation 4111 Monarch Way NORFOLK, VA 23508-2561 (757)683-4293
NSF Program(s):	BE: NON-ANNOUNCEMENT RESEARCH, BIOLOGICAL OCEANOGRAPHY, EDUCATION/HUMAN RESOURCES,OCE, COLLABORATIVE RESEARCH, PIRE
Program Reference Code(s):	0000, 9169, 9198, 5978, 7566, OTHR, EGCH, 5927, 9196
Program Element Code(s):	1629, 1650, 1690, 7298, 7742

ABSTRACT

OISE-0730256 (Carpenter; Old Dominion University Research Foundation)

PIRE: Origins of High Marine Biodiversity in the Indo-Malay-Philippine Archipelago:

Transforming a Biodiversity Hotspot into a Research and Education Hotspot

ABSTRACT

The Indo-Malay-Philippine Archipelago (IMPA) is a biologically, geologically, economically and cultural dynamic region of the world. It is also the global epicenter of marine biodiversity, yet the evolutionary origins of this diversity remain a mystery because the mechanisms driving speciation in the marine realm are poorly understood. Active research in the IMPA pales to the intensive focus on the Great Barrier Reef and Caribbean because of the bureaucratic, cultural and linguistic challenges that face US scientists conducting research in the IMPA. This PIRE (integrated international research and education) project joins the U.S., Indonesia, Malaysia and the Philippines in researching the distance over which marine populations are connected by larval dispersal, the magnitude of this exchange, the dynamic physical processes that shape dispersal and the evolutionary consequences of the interplay of larvae and their physical environment. Professor Kent Carpenter in the Biological Sciences Department at Old Dominion University in Norfolk, Virginia leads the partnership with two other U.S. institutions: Boston University and Duke University. A number of other U.S. universities will also be participating. The project will train 6 postdocs, 22 graduate students and 16 undergraduate students on the U.S. side over a period of five years. The Indonesian partners are the Indonesia Institute of Sciences, Diponegoro University, the State University of Papua and Udayana University. The Malaysian partners are the University of Sains Malaysia, the Borneo Marine Research Institute and the University of Malaysia. The Philippine partners are the University of the Philippines, the Philippines Bureau of Fisheries and the U.S. Peace Corps in the Philippines. The organization Conservation International is also participating. The resulting international and institutional ties will open new opportunities for exchange among U.S. and IMPA countries.

Moving beyond traditional biogeography and phylogeography, this project is advancing the science of speciation in marine environments by integrating spatially explicit geospatial advective predictive models of larval dispersal with multi-locus estimates of gene flow of fish and invertebrate populations across the Philippines, Malaysia and Indonesia. A broader impact of this project will be to contribute to marine biodiversity conservation and management. Marine environments provide food, pharmaceuticals and a broad array of ecosystem services, but are in decline worldwide. Understanding the processes that generate marine biodiversity is critical to conservation of marine environments. In particular, knowing how ocean currents affect the dispersal of marine larvae is essential to effective design of marine reserve networks and enhanced management of fisheries at the population level. Better understanding of the origins of marine biodiversity in the IMPA will lead to a better understanding of the evolution of biodiversity on the planet and how to safeguard this biodiversity.

This project is co-funded with the Division of Oceanography in the Directorate for Geosciences.

PUBLICATIONS PRODUCED AS A RESULT OF THIS RESEARCH

Maralit BA, Aguila RD, Ventolero MFH, Perez SKL, Willette DA, and Santos MD. "Detection of mislabeled commercial fishery products in the Philippines using DNA barcodes and its implication to food traceability and safety," *Philippine Bureau of Agricultural Research R&D Digest*, v.13, 2011, p. 1.

Willette DA, Santos MD, and Aragon MA. "First report of the Taiwan sardinella Sardinella hualiensis (Clupeiformes: Clupeidae) in the Philippines," *Journal of Fish Biology*, v.79, 2011, p. 2087.

Carpenter K. E., P.H. Barber, E.D. Crandall, M.A. Ablan-Lagman, Ambariyanto, G. Ngurah Mahardika, B.M. Manjaji-Matsumoto, M.A. Juinioâ??

MeÃ±ez, M.D. Santos, C.J. Starger, and A. H. A. Toha. "Comparative Phylogeography of the Coral Triangle and Implications for Marine Management," *Journal of Marine Biology*, 2011, p. 1-14.

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Phone: 757-683-3595 FAX: 757-683-5283

3 December 2012

Dr. Binh Thuy Dang
Institute for Biotechnology and Environment
Nha Trang University
02 Nguyen Dinh Chieu Street
Nha Trang City, VIETNAM

Subject: USAID/NSF Partnerships for Enhanced Engagement in Research (PEER) project in Vietnam titled "Conservation Genetics for Improved Biodiversity and Resource Management in a Changing Mekong Delta"

Dear Dr. Binh Thuy Dang,

Your proposed PEER project represents a significant extension and enhancement of the National Science Foundation (NSF) Coral Triangle Partnerships for International Research and Education (CT-PIRE) project: "Origins of high marine biodiversity in the Indo-Malay-Philippine Archipelago: transforming a biodiversity hotspot into a research and education hotspot (NSF Award ID: 0730256). This PIRE project aims to build an active multi-national collaborative population genetic research program that has the capability to address scientific questions relating to the origins of marine biodiversity in Southeast Asia. Population genetic studies and information that these provide on connectivity are also very useful for resource management and biodiversity conservation strategies. This is important in the Mekong Delta of Vietnam where there are numerous threats to aquatic biodiversity from hydroelectric development of the Mekong River Basin, development in the Mekong Delta, fishing pressure and changes in salinity and sea level in this low-lying region from climate change. In order to meet the extreme challenges of resource management and biodiversity conservation in this region, there is urgency to expand our research capabilities. Your proposed PEER project will not only provide valuable scientific data for improved natural resource and biodiversity management, but it will also enhance higher education capabilities in Vietnam in the emerging field of advanced genomics.

In the CT-PIRE project so far, we have uncovered very interesting and often unexpected broad-scale patterns of population breaks and connectivity across Southeast Asia. Much of this work provides valuable evidence on the origins of biodiversity in this region and is in the process of being formalized for manuscript submission to peer-reviewed journals. The population breaks observed includes four population genetic breaks in Indonesia and six in the Philippines, each corroborated by two or more species. This has led to our ability to infer minimum management areas that can be used as a biological basis for ecosystem-based resource management. Furthermore, our results indicate a difference in population genetic structure of the redspot emperor fish, *Lethrinus lentjan* in Vietnam north and south of the Mekong River outflow. However, at present, we do not have sufficient sampling coverage to determine if the actual

effect is because of the Mekong River. The outflow of Mekong River may present a substantial barrier to gene flow and this way influence how marine resources should be managed north and south of the Mekong Delta. This question is particularly relevant with present hydroelectric development along the Mekong River that could potentially change the strength of the outflow of the Mekong River into the South China Sea. It is important at this time to establish patterns of marine connectivity north and south of the Mekong River outflow in order to understand any changes in the marine environment that will occur as a result of development along the river and the increasing effects of climate change. This understanding will be important for future resource management in Vietnam. Similarly, understanding patterns of connectivity of estuarine and freshwater species will also inform decisions about biodiversity conservation and resource management in the highly diverse and resource-rich Mekong Delta. It will also help us better understand the origins of biodiversity in this region.

Questions relating to marine connectivity across the South China Sea and along the coast of Vietnam lead us to propose to the NSF Office of International Science and Engineering a planning visit to potentially expand the work of the CT-PIRE project across the South China Sea to Vietnam. This planning visit was approved and supported by the NSF and led to a mission to that country in October, 2011 by four representatives from the CT-PIRE project. As a consequence of our interactions with Nha Trang University, we determined that a collaborative research effort was feasible and we were greatly encouraged by enthusiastic response from you and the administration at your institution. Subsequently, NSF approved a change of research plans for the CT-PIRE project to work in Vietnam. This resulted in the conducting of a Molecular Ecology course at Nha Trang University during the first half of 2012 by the Old Dominion University/NSF CT PIRE Post-Doctoral Associate and graduate students to initiate this collaboration and begin a collaborative research program. However, our approval to work in Vietnam as part of the PIRE project does not directly support researchers in Vietnam or research in the Mekong Delta. Therefore, your proposed PEER project will be an important means to ensure that this collaboration meets its full potential and is able to extend its activity into the Mekong Delta.

Your proposed PEER project will extend the capability of the CT-PIRE project by encompassing the latest advanced genomics methodology. The CT-PIRE project began when advanced genomics methods were just being developed. Consequently, this project relied on the prevailing methods of mitochondrial gene sequencing and on previously developed nuclear microsatellites since new development was too costly and time consuming to undertake within the project. Microsatellites and other markers such as Single Nucleotide Polymorphisms can be more rapidly and reliably developed using advanced genomic methods. To take advantage of the latest in advanced genomics methodology in Southeast Asia, I proposed to NSF to support a project entitled “Pan-Pacific Advanced Studies Institute, Genomic Applications to Marine Science and Resource Management in Southeast Asia.” This was held in the Philippines in July of 2012 and I was very pleased that you and two other members of your laboratory were able to attend and learn advanced genomic methods at this two-week meeting. Your proposed PEER project therefore will enhance your capability to carry out this type of research in Vietnam by supporting its direct use in research for the first time in you laboratory. If your PEER project is approved, we will also host representatives from your laboratory at Old Dominion University for further training in advanced genomics.

The CT-PIRE project completed its proposed five-year project time-span in September of 2012. However, because of delays in permits being approved during earlier phases of the project, there are resources remaining to keep an active engagement in Southeast Asia for an additional two years. I already exercised the automatic one-year extension option on this project and requested a second year no-cost extension to carry this through Fall, 2014. NSF has already indicated that this is approved. Furthermore, I have plans to submit additional NSF proposals in order to continue collaborative research in Southeast Asia beyond the full extent of the CT-PIRE project. I have an intense interest in continuing collaboration in the scientific discovery potentials of the PEER project and to advancing marine conservation in the Southeast Asian biodiversity hotspot, including the Mekong Delta. The participants in the PEER project will be included in CT-PIRE activities when appropriate. For example, PEER graduate students will be included in another CT-PIRE course in advanced genomics in aquatic and marine molecular ecology to be held in 2013. I will continue to make myself and my Post-Doctoral Associate, Dr. Demian Willette available for mentoring, analyses, authorship and other relevant collaboration in the PEER project. I also have graduate students that I hope to encourage to continue collaborating and assisting in the PEER project. We also have a new faculty coming to Old Dominion University with expertise in advanced genomics in molecular ecology to further help our projects develop in this field. As Principal Investigator of the CT-PIRE project, I will commit all available resources to ensure the success of the proposed PEER project as this will significantly contribute to the scientific and broader impact goals of the CT- PIRE project. We are dedicated to the broader impacts of using the results of our research for biodiversity conservation and resource management and are looking forward to helping you extend this application to the many problems facing the Mekong Delta of Vietnam

Yours sincerely,

Kent E. Carpenter
Professor, Biological Sciences
Principal Investigator, NSR PIRE Project: 0730256

TRƯỜNG ĐẠI HỌC NHA TRANG
NHA TRANG UNIVERSITY

Add: 2 Nguyen Dinh Chieu St., Nha Trang City, Vietnam; Tel: (84).58.2471.303
Fax: (84).58.3831147; Email: dea@ntu.edu.vn; Website: http://www.ntu.edu.vn

November 30, 2012

PEEP Program
The National Academies
500 5th St NW – KWS 502
Washington. DC 20001. USA
Email: peer@nas.edu
Tel: +1 - 202 - 334 - 3656
+1 - 202 - 334 - 1728

TO WHOM IT MAY CONCERN:

It is my pleasure to write this letter in support of the proposal "***Conservation Genetics for Improved Biodiversity and Resource Management in a Changing Mekong Delta***" submitting to the Partnerships for Enhanced Engagement in Research (PEER) Grant by the Institute for Biotechnology and Environment, Nha Trang University, (NTU)

On behalf of NTU, we are committed to support the team on Biodiversity and Conservation from the Institute for Biotechnology and Environment in the registration and implementation of the project. The Institute for Biotechnology and Environment has its faculty members and experienced researchers in the field of Biotechnology and Environmental engineering. They have been involved in many international projects with Norway, Australia, France and USA.

NTU will assure to provide resources available for the project as offices, laboratories, facilities and equipment for research.

In conclusion, I fully support the efforts of the team on Biodiversity from the Institute for Biotechnology and Environment as they seek external funding to support a program designed to enhance the knowledge about conservation genetics to improve biodiversity and resource management/conservation in Mekong Delta. Their ability and performance demonstrate that they have well prepared for their academic achievements.

I give my highest recommendations for the above-mentioned research team for your consideration. Should you need any more information about this, please do not hesitate to contact me at hieutruongtsb@moet.edu.vn.

Sincerely,

BỘ GIÁO DỤC VÀ ĐÀO TẠO
TRƯỜNG ĐẠI HỌC NHA TRANG

Vu Van Xung, PhD
Rector

RESPONSE FROM APPLICANT (7/9/2013) TO QUESTIONS FROM USAID

Question raised in review process:

"You have proposed to study three species comprising smallscale croaker (freshwater species), sabertooth thryssa anchovy (estuarine species) and redspot emperor snapper (marine species). Please provide further explanation of your choice of species. It is very critical to study the connectivity of endemic species for conservation and management purposes. Among the three species proposed for the study, are any endemic? Additionally, it is not clear why a marine fish species—which seems less likely to be deleteriously impacted by climate change and development—is proposed for the study. Please provide your rationale for inclusion of the redspot emperor snapper."

Response:

Thank you for raising these points as they are something we wanted to address in the proposal but could not because of the space limitations.

We are in agreement that consideration of endemic species is important for conservation and management purposes. We initially sought to include endemic species in our study but soon realized that this would not be possible if we are to realize the goals of the project. Part of the reason for this is the scarcity of endemic species in the Mekong River system in general, and the very few endemic species in the Delta region of the Mekong, in particular. We confined our study to Vietnam because this encompasses the Mekong Delta and because this is going to be one of the most heavily impacted areas from climate change and the many planned dams upriver. There are 470 marine fishes recorded from the Mekong Delta of which only 4 are endemic species to the Mekong River (Campbell, 2012). Therefore, the choice to study endemic fishes in the Mekong Delta is limited. In addition, in order to successfully sample population level samples sizes (about 50-60 individuals) we needed to choose species that are commonly caught in fisheries. This also limited our choice of species and precluded the choice of any of the few endemics that are found in the Mekong Delta.

We are limited in the number of species we can practically study within the time and financial constraints of the project but were fortunate to identify three species commonly caught in fisheries that are representative of the main habitat types and behaviors that will change as the Mekong Delta changes. The freshwater species we chosen, is non-migratory and therefore most likely to show population structure within the delta and is representative of what may happen to freshwater fish in the Delta. The estuarine environment of the Delta is extensive and most likely to undergo changes and therefore we needed to include an estuarine species as well. Although, the Mekong River is considered primarily freshwater, the marine influence in the Delta is very important. Of the 470 species that are recorded in the Mekong Delta, many of these are marine species that utilize the estuarine environment for part of their life cycle. It was also therefore important to include a marine representative in this study and the one

we chose is commercially important and already shows population genetic structure across Vietnam according to our preliminary data. It therefore has a good likelihood that it will be able to identify if changes in the Mekong River will ultimately effect the many marine species that rely on the Mekong Delta as well. The Mekong River not only strongly influences the life history behavior of marine fishes in the region, changes in the flow of water may strongly influence the genetic structure of marine populations north and south of the river as it may serve as a barrier to dispersal of marine species along the coast of Vietnam. We wish to identify what potential genetic structure occurs in these marine species (in particular the ones that are commercially important) and what may potentially be impacted by changes in the Mekong River.

The objectives of our study will ultimately help to conserve and manage endemic species, since our insights will help understand what level of population structuring is typical of the Mekong Delta. In addition to conservation of endemic species, the management of genetic resources is important. For example, a great deal of effort is placed on conserving the various riverine stocks of salmon on the West coast of the U.S. in order to preserve the genetic integrity of the different populations. Although the overwhelming majority of fish species in the Mekong River are not endemics, it is very likely that they represent unique populations genetically (e.g. Nguyen & Sunnucks, 2012). The maintenance of the unique endemic populations of the Mekong is important, even if they are not one of the few endemic species to the Mekong.

We spent considerable time considering which species could be practically sampled and analyzed to meet the goals of the project and believe we chose the most appropriate ones. However, if after discussions with USAID and other scientists that work on the Delta, some other species are deemed to be more important and practically sampled, we can certainly consider changing our methodology. We are also very interested in ensuring that our project is most useful for conservation and management and can adapt our methodology if a better choice is identified.

Literature Cited

Campbell IC. 2012. Chapter 11. Biodiversity of the Mekong Delta. In, The Mekong Delta System. Springer Environmental Science and Engineering. 4: 293-313.

Nguyen TTT and Sunnucks P. 2012. Strong population genetic structure and its management implications in the mud carp *Cirrhinus molitorella*, an indigenous freshwater species subject to an aquaculture and culture-based fishery. *Journal of fish*

Robbins, Kelly

From: Teresa Leonardo [tleonardo@usaid.gov]
Sent: Monday, July 01, 2013 4:37 AM
To: Robbins, Kelly; Danielle Tedesco
Subject: Re: FW: PEER Science Project 7 - Dang Thuy Binh (Vietnam)

Dear Kelly,

Thanks much! I will write to Kent about scheduling a meeting while he is in Bangkok.

Also - the response we received from them (in your other email) fully meets our needs for finalizing this award.

The Vietnam Mission would also like to meet with them at the start of the project-- the VN Mission has further suggested that it could be good to have a consultation seminar with involvement of fisheries scientists active in the Mekong Delta at the beginning of the project - they specifically mentioned, Can Tho University and An Giang University (based right in the middle of the Mekong Delta); and Research Institute for Aquaculture 2 (RIA2 - based in Ho Chi Minh City) as very strong in fisheries science.

I'll mention this to Kent when we see him to see if this, or something along these lines, might be possible.

best
t

Teresa Leonardo, Ph.D. | Regional Science & Technology Advisor
USAID Regional Development Mission for Asia | Regional Environment Office
Tel. +66-2-257-3219 | Fax. +66-2-257-3099 | tleonardo@usaid.gov

best teresa

On Fri, Jun 28, 2013 at 6:34 AM, Robbins, Kelly <KRobbins@nas.edu> wrote:
Hi Teresa,

Following is a message I received from the U.S. partner on PEER Science proposal 7, Conservation Genetics for Improved Biodiversity and Resource Management in a Changing Mekong Delta, from PI Dang Thuy Binh of Vietnam. This was the proposal on which you requested that they provide additional details about the fish species included in the project and that they meet with you and with Vietnam mission staff. The PI and U.S. partner will be in Bangkok in late July and are proposing to meet with you then if it's convenient. Their e-mail addresses are in the message below if you would like to try to set something up with them. I'm away on leave 6/28 through 7/8 but will be checking e-mail each day in case you would prefer that I send them a message from you instead.

Best regards,
Kelly

From: Carpenter, Kent E. [kcarpent@odu.edu]
Sent: Thursday, June 27, 2013 7:17 PM

To: Robbins, Kelly
Cc: 'binhdangthuy@gmail.com'
Subject: RE: Your Proposal to the PEER Science Program

Dear Kelly, Thank you for this very good news. Thuy Binh and I are completing a response to the question that was raised and this will be sent to you soon. We hope you will find it answers the question adequately.

We are also very happy to meet with both regional and Vietnam USAID mission people to discuss the plans for the project and to adapt the project more to their needs if practical. It so happens that I plan to be in Thailand for my NSF PIRE project the week of 29 July to 2 August and could potentially dedicate a day for meetings in Bangkok if this is desired. If you think this is a good idea, please let us know who would be best to contact to try to set this up. Thuy Binh also said she would be available that week if there is an opportunity to meet and discuss the project in Bangkok. If that week does not turn out to be good for USAID representatives, we will set up an alternative time to meet with them.

Many kind regards, Kent

Kent E. Carpenter
Professor
Department of Biological Sciences, PSB 3120A
Old Dominion University
Norfolk, Virginia 23529-0266 USA
& Manager, IUCN Global Marine Species Assessment/ IUCN Species Programme Marine Biodiversity Unit:http://www.sci.odu.edu/gmsa/
Coral Triangle PIRE project: www.sci.odu.edu/impa/ctpire.html
Office Phone: (757) 683-4197
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Email: kcarpent@odu.edu http://sci.odu.edu/biology/directory/kent.shtml

---

From: Robbins, Kelly [KRobbins@nas.edu]
Sent: Thursday, June 20, 2013 10:46 AM
To: 'binhdangthuy@gmail.com'
Cc: Carpenter, Kent E.
Subject: Your Proposal to the PEER Science Program

Dear Dr. Dang Thuy Binh,

In consultation with our program sponsors at the U.S. Agency for International Development (USAID) we recently completed our evaluation process, and your proposal entitled "Conservation Genetics for Improved Biodiversity and Resource Management in a Changing Mekong Delta" was one of only 54 recommended for funding from among the 237 eligible applications submitted. The selection process was extremely competitive, so you can be very proud that your project was among the strongest in the excellent group of proposals we received. A list of all projects selected in this round of the program is posted at http://www.nationalacademies.org/peerscience.

Your project has been tentatively approved for funding in the amount of $120,000 requested over two years, but final approval and issuance of this grant will depend on the adequacy of your responses to the following question raised in the review process:

> "You have proposed to study three species comprising smallscale croaker (freshwater species), sabertooth thryssa anchovy (estuarine species) and redspot emperor snapper (marine species). Please provide further explanation of your choice of species. It is very critical to study the connectivity of endemic species for conservation and management purposes. Among the three species proposed for the study, are any endemic? Additionally, it is not clear why a marine fish species—which seems less likely to be deleteriously impacted by climate change and development—is proposed for the study. Please provide your rationale for inclusion of the redspot emperor snapper.

> "Additionally, the USAID Regional Development Mission for Asia and the USAID Vietnam Mission would like to meet with the team at the outset of the project to discuss the proposed activities, and the potential to include additional sites in this study. There may be opportunities to build linkages with other USAID-supported activities to increase the conservation impact of the proposed research."

Please provide your responses to the questions above at your earliest convenience in the form of a Word document to be e-mailed to krobbins@nas.edu. If approved, your responses will be included in your proposal as an attachment. As noted above, we cannot proceed with final approval of your grant until we have received your responses and they have been approved by relevant USAID staff members.

If you have any questions, please let me know. I look forward to receiving your responses on the issues raised above.

Best regards,

Kelly

Kelly Robbins

Senior Program Officer

The National Academies

Policy and Global Affairs

500 Fifth Street, NW - Room 542

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krobbins@nas.edu

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