The VIP CORALS Marine Repository Hub: Laying foundations for science and discovery in the VIP

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The Philippines is said to be the center of the center of marine shore fish biodiversity because of a key marine biodiversity corridor known as the Verde Island Passage (VIP), which has up to 1,736 species over a 10 x 10 km area (Carpenter and Springer 2005). The VIP harbors a vast and rich marine life and is home to numerous other marine organisms, from microorganisms to seagrass, seaweeds, mangroves, corals and other invertebrates, cetaceans, and other species of fish, many of which have yet to be documented. Given the known threats on the marine environment, studies have noted that the VIP is an area of extremely high priority for biodiversity conservation (PAWB 2009; Asaad et al. 2018).

The VIP is located in the southern part of Luzon in the Philippines and covers an area of 14,000 km2 (PAWB 2009). Five provinces border the VIP, namely, Batangas, Marinduque, Occidental Mindoro, Oriental Mindoro, and Romblon. Over 4.5 million people are living in these provinces as estimated from the 2015 census (PSA 2017), and numerous people in these areas are supported by the VIP in terms of fishery production and tourism (PAWB 2009; Boquiren et al. 2010). Studying this highly diverse hotspot is therefore critical for its conservation and the well-being of those that depend on this marine ecosystem and its services.

Most biodiversity studies on the VIP focus on Batangas and Oriental Mindoro (PAWB 2009), with many centering on specific taxonomic groups such as corals, fish, and mangroves. Limited studies on seaweeds, seagrass, and other organisms such as invertebrates and microorganisms have been conducted. Understanding biodiversity and how species and communities respond to global change (i.e., land use change, pollution, biological invasions, climate change, etc.) is vital for conservation and sustainable use and management, especially for biodiversity hotspots such as the VIP. Baseline studies through field observations and experiments are thus crucial to facilitate monitoring and identification of priority areas. Equally important is to document this biodiversity through specimen collection, which provides invaluable information and verifiable records for conducting comparative analyses across time and space.

Expeditions and specimen collections in the VIP have been conducted in the past by local and foreign institutions, the largest of which was the 2011 Hearst Expedition. The expedition was led by the California Academy of Sciences and conducted in partnership with the National Museum of the Philippines, the University of the Philippines, the Bureau of Fisheries and Aquatic Resources, and other institutions in the Philippines and

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Date received: May 11, 2020
Date revised: June 23, 2020
Date accepted: June 30, 2020

Figure 1: The Marine Repository Hub of the Verde Island Passage Center of Oceanographic Research and Aquatic Life Sciences, Batangas State University.

in the United States (Williams 2014). The expedition included specimen collections from shallow water and the deep sea in the VIP, which were transported to the California Academy of Sciences in San Francisco, California (Williams 2014). Other local universities conducting scientific studies in the region may also have collections from the VIP, which may also be used for formal teaching for undergraduate students. Batangas State University has several marine specimens previously collected by students and instructors, which are used as teaching tools in biology subjects and are displayed in the biology laboratories.

As one of the state universities bordering the VIP, the Batangas State University realized the need for a local state university with research focusing on the VIP. The university, thus, established a marine research center, the Verde Island Passage Center for Oceanographic Research and Aquatic Life Sciences (VIP CORALS), in 2018, and one of its first projects was to initiate the establishment of a marine repository hub for specimen collections and data on the marine flora and fauna of the VIP (Figure 1). The repository hub includes a museum for specimens of marine organisms such as seaweeds, seagrass, mangroves, invertebrates, and fish collected from the VIP. It also includes a library for published works, technical reports, and other related data. An online database was also developed to catalogue the collected and preserved specimens, as well as data and reference materials related to the VIP. The repository hub is envisioned to be a centralized facility for specimen collections and data on the VIP. It aims to aid in the identification of the marine resources, as well as organize and consolidate new and existing data, to provide a comprehensive baseline knowledge on this highly diverse marine region for its conservation and sustainability. Documenting the biodiversity in the VIP through collections and surveys will also allow us to monitor the state of these resources and understand how this region contributes to biodiversity on a wider scale.

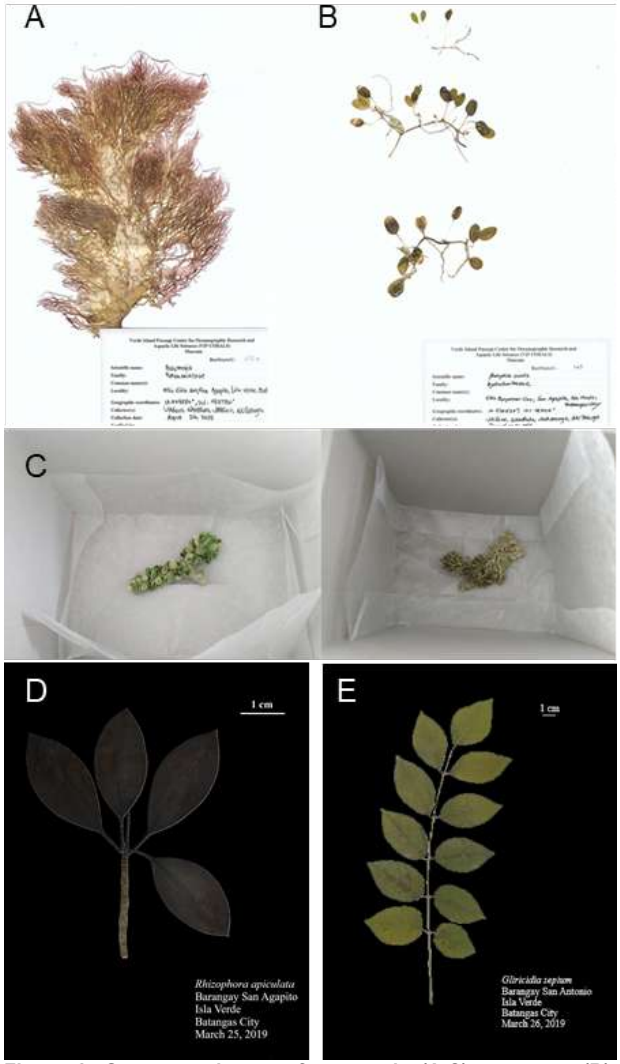

Figure 2: Some specimens of seaweeds (A,C), seagrass (B), mangrove (D), and beach forest (E) from collections conducted in Verde Island, Batangas City, Batangas and deposited to the VIP CORALS Marine Repository Hub of the Batangas State University.

The project ran alongside another university-funded project titled "Survey of vulnerable, threatened, endangered, and economically important marine organisms in Verde Island, Batangas City." Verde Island lies at the heart of the VIP, and information on its biodiversity is lacking. Specimens were gathered during the survey and preserved and stored as collections of the repository. Proper clearances were secured prior to collecting. These specimens comprise most of the current collections of the museum. Some of the collections also include voucher specimens from students who conducted their undergraduate thesis research in collaboration with the center.

The specimens were preserved according to the respective protocols for different organisms. A simple database was put up for all specimen holdings. Over 240 specimens have been collected and listed in the database (Figures 2 and 3). The museum currently has 44 specimens of fish, 44 specimens of invertebrates, 9 specimens of mangrove, 16 specimens of beach forest species, and 128 specimens of seaweeds and seagrass. Photographs of corals were also taken. Collections from the surveys were photodocumented as part of the database establishment. Photos may be accessed upon request from the center's database. Some of the photos may be viewed at the dedicated page for the marine repository hub at the center's website for public viewing (http://vipcorals.batstate-u.edu.ph/marine-repository-hub/).

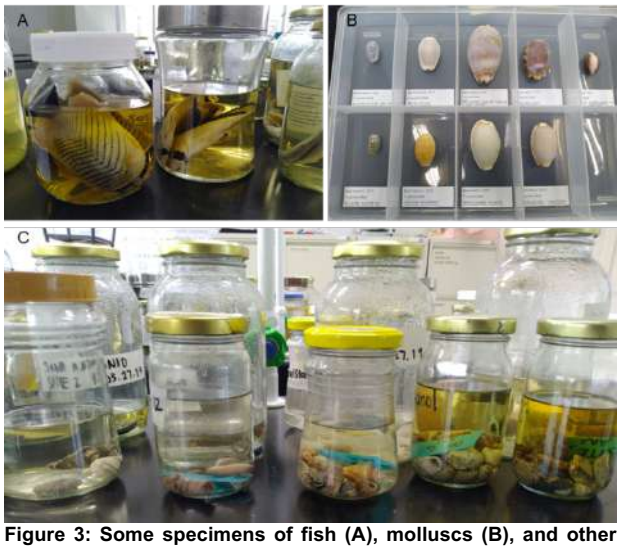

Figure 3: Some specimens of fish (A), molluscs (B), and other invertebrate species (C), from collections conducted in Verde Island, Batangas City, Batangas and deposited to the VIP CORALS Marine Repository Hub of the Batangas State University.

These collections, aside from their function in contributing to studies on biodiversity and ecology in the VIP, are also used to teach taxonomy and systematics to undergraduate students of the BS Biology program in the university. In 2019, the center also accepted interns from the BS Biology program, who took part in the curation work for the marine repository hub (Figure 4).

As part of its extension work, the center participates in marine eco-camps led by the Science, Education, and Advocacy Institute–VIP, where some of these collections are used as "travelling exhibitions" (Figure 5). These exhibits, although small and temporary, impart important learning experiences to participants in an informal setting, especially since many of them do not have the opportunity to go to museums or are not aware of these underwater marine treasures despite living right next to the VIP. These natural history collections are crucial not only for the conduct of scientific research but also plays a significant role in educating the locality of their natural heritage. Collections and exhibits of natural history provide a sense of "visibility, appreciation, identity and awareness of local culture,

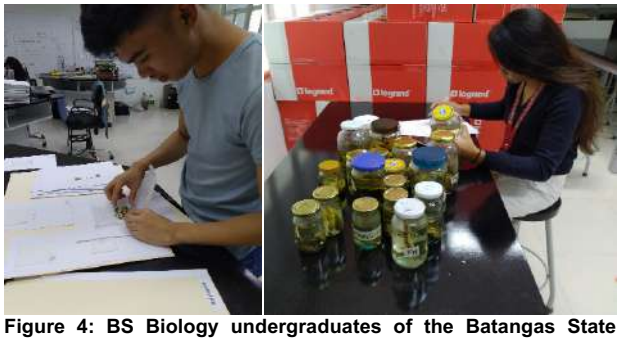

Figure 4: BS Biology undergraduates of the Batangas State University doing museum work for the VIP CORALS Marine Repository Hub as part of their internship at VIP CORALS.

Figure 5: Specimen collections used in exhibits for marine eco-camps led by the Science, Education, and Advocacy Institute–VIP for public grade schoolers in Lobo, Batangas. Photos by Joseph Ascalon of the Science, Education, and Advocacy Institute–VIP.

flora, and fauna" (Bakker et al. 2020). In doing so, locals may also gain a sense of stewardship for their natural environment.

In addition to the museum for biological specimens, a dedicated library was also initiated as part of the marine repository hub. The library aims to collate reference materials, primarily studies conducted on the VIP, as well as other reference materials that will support the research, teaching, and extension activities of the museum and the center. Most of the holdings have been donated by the center's researchers, as well as colleagues from partner institutions. The library has now cataloged over 500 printed and online materials, which include journals, reprints, technical reports, and books. Over 100 articles concerning the VIP have been tagged and included in the database. This catalog can be currently accessed through the center's Mendeley account via the center's desktop or remotely over at https://www.mendeley.com/community/vip-corals-library. Access requires a free sign-up at Mendeley.

Museums of natural history serve as "academic nexes of integration" by linking various disciplines in science, arts, and humanities and "innovation incubators" for addressing emerging questions related to the natural world and the society (Bakker et al. 2020), and the same is also true for university-based natural history museums such as the VIP CORALS Marine Repository Hub. The museum and library, as well as the online database, of the marine repository hub contribute to the mission of VIP CORALS in providing research, teaching, and extension services on the marine resources and environment in the VIP and to the university's mission of "producing leaders by providing a 21st century learning environment through innovations in education, multidisciplinary research, and community and industry partnerships in order to nurture the spirit of nationhood, propel the national economy, and engage the world for sustainable development."

Currently, specimen collections are housed in one of the biology laboratories in the main campus of the university. Library collections, on the other hand, are currently stored in VIP CORALS–Lobo. Eventually, both museum and library collections will be housed in the main research station currently being constructed in the Lobo campus.

Much work is to be done to ensure the continuity of the repository and enrich its collections, given that these specimens, data, and reference materials are fundamental in conducting baseline studies and expanding research and discovery in the VIP. Curation requires constant organization and verification of specimens to ensure the integrity of the collections for current and future research and teaching purposes. As with other natural history and library institutions and collections, securing stable funding and adequate staffing and training, increasing accessibility, and promoting digitization are among the many tasks that lie ahead. Biological collections need to expand across time, geographic scale, and taxa to increase its scientific value. Although still at its infancy, the marine repository hub is actively growing its specimen and library collections through its projects and collaborations. The center is currently implementing the project titled "Marine Biodiversity Assessment in Selected Areas along the Verde Island Passage (MBioAssess-VIP)," which is funded by the Department of Science and Technology. Among its activities is the collection of seaweed and seagrass specimens, which will be stored in the marine repository hub. Additionally, the university is developing its Master of Science in Marine Biology program, whereby students may conduct their research through or in connection with the marine repository hub. The center also welcomes partnerships and collaborations that will promote the development of the marine repository hub, the use of its collections, and ultimately the sustainability of this highly diverse marine ecosystem—the VIP.

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