RESEARCH ARTICLE

Marine biodiversity awareness and engagement among students: Implications for local conservation policy

Zydrick L. Avelino[a,1,*]

[a] Instructor, Bataan Peninsula State University, Bagac, 2107 Bataan, Philippines.
[1]zylavelino@bpsu.edu.ph*

For correspondence:
zylavelino@bpsu.edu.ph

Article history:
Received: 9 October 2025
Revised: 6 March 2026
Accepted: 10 March 2026
Published: 13 March 2026

10.22219/jpbi.v12i1.42443

© Copyright Avelino

This article is distributed under the terms of the Creative Commons Attribution License

p-ISSN: 2442-3750
e-ISSN: 2537-6204

How to cite:
Avelino, Z. L. (2025). Marine biodiversity awareness and engagement among students: Implications for local concervation policy. *JPBI (Jurnal Pendidikan Biologi Indonesia), 12*(1), 1-11. https://doi.org/10.22219/jpbi.v12i1.42443

Abstract:

Background: As a municipality hosting a rich coastal ecosystem, Bagac serves as a vital focal point for translating global marine conservation frameworks into local action. **Objectives:** This study aimed to evaluate higher education students' awareness of marine biodiversity alongside Sustainable Development Goal (SDG) 14—to conserve and sustainably use the oceans, seas, and marine resources—and explore the translational gap between academic research and policy engagement. **Methods:** Utilizing a descriptive cross-sectional survey design, data were collected from 383 undergraduate students using a validated instrument that concurrently captured quantitative ratings and qualitative open-ended responses. **Results:** Quantitative results revealed a significant skill-gap paradox: while students exhibited strong pro-conservation values, 86.9% had never participated in marine research. A strong correlation existed between perceived institutional engagement and academic policy awareness ($\rho = 0.795$, $p < .001$), alongside a significant curricular divide in baseline awareness across academic disciplines ($p = .003$). Qualitative thematic analysis attributed this translational gap to structural barriers, specifically jargon-heavy academic language and the challenges in collaborative platforms with local government. **Conclusion:** Theoretical environmental awareness experiences challenges in policy translation without active institutional scaffolding. Universities may bridge this science-to-policy gap by systematically integrating SDG 14 across all curricula and establishing platforms to train students in translating research into actionable local policy.

Keywords: coastal conservation; higher education; marine biodiversity; policy translation; SDG 14

Introduction

It is a fundamental reality that the world's oceans, covering over two-thirds of the Earth's surface, harbor an immense biodiversity vital to overall planetary health, climate regulation, and human survival (Lotze, 2021). As a global epicenter of this marine biodiversity, the Philippines sits at the apex of the Coral Triangle, possessing an extraordinary concentration of species. However, this ecological heritage is increasingly imperiled by anthropogenic stressors, including habitat destruction and overexploitation (Binobo et al., 2024; Roleda & Benayahu, 2024). These escalating threats are projected to constrain species' metabolic performance and trigger large-scale ecosystem reorganizations (Deutsch et al., 2025; Meyer et al., 2024), directly exacerbating socio-economic vulnerabilities like food insecurity and weakened coastal resilience in the region (Elyza et al., 2024).
To address these crises, the scientific community has rapidly advanced its monitoring and conservation tools. Current efforts range from foundational taxonomic inventories and DNA barcoding (Bemis et al., 2023; Garcia & Anticamara, 2023; Huang et al., 2023) to large-scale assessments using environmental DNA (eDNA), remote sensing, and comparative phylogeography (Dalongeville et al., 2022; Fasola et al., 2025; Kavanaugh et al., 2021; Valsecchi et al., 2021). Despite these innovations, geographic and taxonomic biases persist, creating blind spots in biodiversity data (Bouchet et al., 2023; Mugnai et al.,

2021). Furthermore, literature increasingly emphasizes that successful conservation blueprints cannot rely on ecological science alone; they must integrate local human systems (Magris et al., 2021). For instance, the efficacy of Marine Protected Areas (MPAs) and citizen science initiatives heavily depends on active learning among learners, community participation, and environmental education (Avelino, 2025; Davis et al., 2022; Dionisio et al., 2022; Mecha et al., 2022; Marriott et al., 2021).

Despite this wealth of scientific advancement, a critical translational gap persists at the intersection of knowledge generation, higher education, and local governance. While the literature thoroughly documents marine biodiversity, it seldom investigates the crucial human dimension of science-to-policy translation—specifically, the awareness and engagement of higher education students. This gap is compounded by structural inequalities in global research that often limit the capacity of local institutions in biodiversity-rich nations to translate global science into local action (Tolochko & Vadrot, 2021). The novelty of the present study lies in its contextual integration: rather than treating environmental concern as a broad abstraction, it investigates the specific pathway from academic awareness to policy engagement among students in the coastal municipality of Bagac, Bataan. By focusing on this specific demographic, the study explores how advanced scientific insights risk remaining inert unless effectively translated into local curricula and grassroots initiatives.

Therefore, this study aims to assess the awareness and engagement of higher education students in Bagac, Bataan concerning marine biodiversity, providing insights to strengthen the linkage between academic research and marine biodiversity aspects. The general objective is to evaluate students' perceptions of marine biodiversity and explore how academic research aligned with Sustainable Development Goal 14 (Life Below Water) can be effectively translated into relevant local policies. Specifically, the research seeks to determine the students' awareness and engagement of marine biodiversity, evaluate the extent of their engagement in marine research, and identify the perceived barriers and opportunities in translating this academic knowledge into actionable local policy recommendations and community-based conservation efforts.

Method

Research design

This study utilized a descriptive cross-sectional survey design. This approach was deliberately chosen to achieve a comprehensive understanding of student awareness regarding marine biodiversity and the dynamics of research-to-policy translation in Bagac, Bataan. Within this non-experimental framework, the quantitative data derived from the structured survey provided a broad, representative assessment of students' awareness levels and patterns of engagement. Complementing this, the qualitative data—collected concurrently through open-ended components within the same instrument—offered specific, contextualized insights into the perceived mechanisms and barriers related to the local science-policy interface.

Participants and sampling

The research was conducted at the Bataan Peninsula State University – Bagac Campus. The target population comprised 545 undergraduate students across three academic programs: the Bachelor of Elementary Education (BEEd), Bachelor of Industrial Technology (BIndTech), and Bachelor of Science in Business Administration (BSBA). To determine the minimum required sample size, Cochran's formula with a finite population correction was utilized, assuming a 95% confidence level and a 5% margin of error. The calculation established a minimum threshold of 226 participants to ensure statistical validity.

Because data were collected via online forms distributed through class channels, true random sampling was not feasible. Therefore, the study adopted stratified convenience sampling technique with proportional targets. A total of 383 valid responses were obtained. By significantly exceeding the minimum required sample size and capturing approximately 70% of the total population, the study greatly enhanced the reliability of the data and minimized the potential for non-response bias (see Table 1).

Table 1. Distribution of respondents

Program	Population (N)	Population in %	Expected Sample (n)	Actual Sample (n)	Difference
BEEd	178	32.66%	74	155	+81
BIndTech	197	36.15%	82	132	+50
BSBA	170	31.19%	70	96	+26
Total	545	100%	226	383	—

The proportional allocation procedure initially set the expected minimum samples at 74 for BEEd, 82 for BIndTech, and 70 for BSBA, totaling 226 respondents. However, actual data collection yielded 383 valid responses. Across programs, all strata exceeded their expected numbers. BEEd students contributed 155 responses (+81), BIndTech produced 132 respondents (+50), and BSBA yielded 96 responses

(+26). These variations indicate strong voluntary over-participation across all groups, ensuring comprehensive coverage of the population.

Data gathering instruments

The primary instrument developed for this study is the Marine Biodiversity Awareness & Perception Survey (MBAPS). This researcher-developed questionnaire included demographic questions and several sections with Likert-scale items designed to measure specific constructs: Awareness and Understanding, Perceived Importance, Policy Awareness, and Willingness to Engage. It also included open-ended questions at the end to capture qualitative insights regarding perceived barriers to policy translation.

The instrument underwent a rigorous content and face validation process by a multidisciplinary panel of four experts (one social science expert, one language expert, and three science education experts) to verify scientific accuracy, readability, and freedom from bias. Following the rigorous content and face validation by the expert panel and the initial pilot testing, the internal consistency of the multi-construct Likert instrument was statistically evaluated. Cronbach's alpha was calculated using the final dataset of 383 respondents. The reliability analysis yielded an excellent overall coefficient of $\alpha = 0.945$, indicating very strong internal consistency across the scales and confirming the instrument's robust reliability for the descriptive aims of this research

Data gathering procedure

Prior to data collection, administrative approval to conduct the study was secured from the Campus Director of the Bataan Peninsula State University – Bagac Campus. Strict ethical research protocols were maintained throughout the process.

The validated survey questionnaire was digitized via Google Forms. The first section included a comprehensive informed consent sheet outlining the study's purpose, the voluntary nature of participation, and measures to ensure data anonymity and confidentiality. Participants were required to provide explicit consent by selecting "I Agree" before proceeding, ensuring that all respondents were fully informed and participated voluntarily.

The Google Form link was disseminated through program-specific channels, including official student group chats and direct endorsements from course instructors. Data collection remained open for a four-week period. During this time, the quantitative ratings and the qualitative open-ended responses were collected simultaneously from the 383 participants.

Results and Discussion

The descriptive analysis of students' responses (N = 383) across the three programs—BEEd, BIndTech, and BSBA—reveals a consistent baseline of moderate familiarity and a generally positive environmental disposition. Across all 17 indicators, the median remained constant at 3.0, signifying a broad consensus of "Agree" on the 4-point Likert scale. However, as shown in Table 2, the intensity of these perceptions varies significantly by program and specific construct.

Quantitative results

Table 2. Comparative analysis of students' self-perceived knowledge and attitudes toward marine biodiversity

Survey Item	BEEd (n=155) *M*±SD	BIndTech (n=132) *M*±SD	BSBA (n=96) *M*±SD
Self-perceived Knowledge and Understanding (Perception of Familiarity)			
Fundamental Concept Familiarity			
Familiarity with marine biodiversity concept	2.99±0.61	2.80±0.75	2.83±0.69
Understanding of environmental importance	3.22±0.63	2.83±0.75	3.02±0.63
Familiarity with SDG 14: Life Below Water	3.05±0.71	2.82±0.79	2.75±0.73
Academic & Policy Awareness			
Learned through academic subjects	2.95±0.71	2.72±0.79	2.72±0.69
Awareness of local conservation policies	2.93±0.64	2.86±0.71	2.77±0.62
Perception of research-to-policy challenges	3.03±0.48	2.88±0.69	2.94±0.58
Research & Competency			
Research relevance to real-life issues	3.40±0.67	2.98±0.78	3.19±0.74
Competency in policy communication	2.80±0.59	2.75±0.72	2.67±0.64
Attitudes & Values (Environmental Disposition)			
Conservation Values & Concern			

Survey Item	BEEd (n=155) *M*±SD	BIndTech (n=132) *M*±SD	BSBA (n=96) *M*±SD
Awareness of local marine ecosystems	2.92±0.73	2.85±0.73	2.90±0.62
Importance for local livelihood	3.35±0.68	2.97±0.76	3.26±0.70
Concern for ecosystem conservation	3.25±0.69	2.89±0.76	3.02±0.60
Perceived Institutional Engagement			
Adequacy of institutional discussion	2.79±0.67	2.79±0.74	2.71±0.56
Institutional opportunities for research	3.17±0.54	2.86±0.74	2.93±0.60
Encouragement for research engagement	3.07±0.60	2.86±0.74	2.95±0.61
Institutional collaboration with LGUs	3.03±0.53	2.86±0.70	2.95±0.55
Proactive Intent & Willingness			
Active seeking of information	2.81±0.68	2.78±0.72	2.69±0.64
Willingness to participate in research-policy	3.08±0.65	2.86±0.79	2.97±0.70

Note. M = Mean; SD = Standard Deviation. Scale: 1 = Strongly Disagree, 2 = Disagree, 3 = Agree, 4 = Strongly Agree.

Self-perceived knowledge and understanding: The skill-gap paradox

In the domain of knowledge and understanding, a notable paradox exists between students' belief in the value of research and their perceived competency to utilize it. While students expressed the highest level of agreement regarding the relevance of academic research to real-life issues (BEEd *M* = 3.40; BSBA *M* = 3.19; BIndTech *M* = 2.98), they simultaneously reported their lowest levels of agreement in their competency to communicate findings to policymakers (BEEd *M* = 2.80; BIndTech *M* = 2.75; BSBA *M* = 2.67). This suggests that the curriculum succeeds in fostering a general appreciation for science, however may indicate challenges to provide the practical policy literacy required for environmental advocacy.

Furthermore, while students are generally familiar with marine biodiversity, their familiarity with SDG 14: Life Below Water is comparatively lower across all groups (*M* range 2.75–3.05). This indicates that institutional knowledge is still largely localized or general and has not yet fully integrated the specific international sustainability frameworks that guide global conservation policy.

Attitudes and values: Passive concern vs. Institutional reliance

The domain of Attitudes and Values reflects a strong pro-conservation sentiment across the campus. The highest scores in this category were found in the recognition of biodiversity's importance for local livelihoods (BEEd *M* = 3.35; BSBA *M* = 3.26; BIndTech *M* = 2.97) and general conservation concern. This high level of affective valuation suggests that students possess the emotional readiness for environmental stewardship.

However, a passive awareness trend is evident in the Proactive Intent category. While students indicate a willingness to participate in research-policy projects (*M* range 2.86–3.08), their scores for actively seeking information were notably lower (*M* range 2.69–2.81). This suggests that students look toward the institution for direction; their environmental engagement is largely dependent on institutional opportunities and encouragement—which BEEd students perceived more strongly—rather than independent initiative.

Disciplinary patterns in perception

A consistent trend throughout the data is that the BEEd cohort reported the highest means and the lowest standard deviations (SD). This suggests that teacher education students have a more cohesive and reinforced perception of environmental topics, likely due to a curriculum that integrates social and environmental responsibility more intentionally, such as in the professional education course – Environmental Education. In contrast, BIndTech students exhibited the highest variability in their responses (e.g., SD = 0.79 for SDG 14), suggesting that environmental literacy in technical programs is more fragmented and perhaps dependent on individual student interest rather than a standardized curricular thread.

Table 3 illustrates a significant gap between students' theoretical awareness and their practical research involvement. A vast majority of the participants (86.9%) reported having never participated in research related to marine biodiversity. While foundational awareness and concern were rated highly in previous sections, these results indicate that such sentiments have not yet translated into active scientific inquiry. Interestingly, although the BIndTech cohort reported lower awareness scores in Table 3, they showed the highest frequency of actual research participation (7.6%) compared to BEEd (2.6%) and BSBA (2.9%). This suggests that participation may currently be driven more by specific technical projects or course requirements relative to the program rather than general environmental interest. The low participation rate across all programs emphasizes a participation barrier, likely stemming from curricular constraints or a lack of structured undergraduate research platforms.

Table 3. Descriptive analysis of students' engagement in research related to marine biodiversity

Have you ever participated in research related to marine biodiversity?	Program	Counts	% of Total	Cumulative %
No	BEED	145	37.9%	37.9%
	BINDTECH	103	26.9%	64.8%
	BSBA	85	22.2%	86.9%
Yes	BEED	10	2.6%	89.6%
	BINDTECH	29	7.6%	97.1%
	BSBA	11	2.9%	100.0%

Table 4 reveals the depth—or lack thereof—of student engagement in marine biodiversity research. While Table 3 established a low participation baseline, Table 4 demonstrates that even among participants, roles are primarily auxiliary. The overwhelming majority (93.0%) selected "None of the above," confirming that research involvement remains a peripheral experience for the general student body.

Of those who engaged, the most common role was that of an "Extension Program Volunteer" (3.4% total), followed by "Co-researchers" and "Data Collectors." The rarity of "Research Leaders" (0.6% total) indicates a lack of student-led inquiry. This distribution suggests a "Top-Down" research culture where students are utilized as labor for data collection or community outreach rather than being integrated into the conceptual or leadership phases of the scientific process. These results bridge the quantitative data with the qualitative "Barriers" identified later, specifically the "Systemic and Structural Constraints" that limit student agency in local environmental governance.

Table 4. Role of students in marine biodiversity research

Frequencies of If yes, what was your role in the research? (Check all that apply)				
If yes, what was your role in the research? (Check all that apply)	**Program**	**Counts**	**% of Total**	**Cumulative %**
None of the above	BEED	148	38.6%	38.6%
	BINDTECH	119	31.1%	69.7%
	BSBA	89	23.2%	93.0%
Extension program volunteer	BEED	3	0.8%	93.7%
	BINDTECH	6	1.6%	95.3%
	BSBA	4	1.0%	96.3%
Research leader, Co-researcher or assistant, Data collector, Extension program volunteer	BEED	1	0.3%	96.6%
	BINDTECH	0	0.0%	96.6%
	BSBA	0	0.0%	96.6%
Data collector	BEED	2	0.5%	97.1%
	BINDTECH	2	0.5%	97.7%
	BSBA	1	0.3%	97.9%
Co-researcher or assistant	BEED	1	0.3%	98.2%
	BINDTECH	4	1.0%	99.2%
	BSBA	1	0.3%	99.5%
Research leader	BEED	0	0.0%	99.5%
	BINDTECH	1	0.3%	99.7%
	BSBA	1	0.3%	100.0%

To determine if the observed variations in students' environmental perceptions were statistically significant across different academic disciplines, a Kruskal-Wallis H test was conducted on the composite mean of marine biodiversity awareness. The results, shown in Table 5, reveal a highly significant difference among the three academic programs (x^2 = 12.02, p = .003).

Table 5. Kruskal–Wallis test of awareness in marine biodiversity across academic programs

Kruskal-Wallis	χ^2	df	p
Composite Mean Awareness	12.0	2	0.003

Note: x^2 = Kruskal-Wallis Chi-Square. ***p* < .01. The test indicates a statistically significant difference in awareness levels among the BEEd, BIndTech, and BSBA programs.

This significant variance confirms the disciplinary trends identified in the descriptive analysis. It statistically validates that environmental awareness is not uniform across the institution; rather, it is heavily influenced by the student's specific curricular track. The data suggests that programs with integrated pedagogical or social sciences components (such as BEEd) foster a significantly different level of environmental awareness compared to highly technical (BIndTech) or corporate-focused (BSBA) programs.

To pinpoint exactly where the disparities in marine biodiversity awareness exist among the cohorts, a Dwass-Steel-Critchlow-Fligner (DSCF) post-hoc pairwise comparison was conducted. As detailed in Table 6, the results reveal that the Bachelor of Elementary Education (BEEd) students possess significantly different—and based on the descriptive means, significantly higher—levels of awareness compared to both BIndTech (*p* = 0.010) and BSBA (*p* = 0.010) students. Crucially, there is no statistically significant difference in awareness between the BIndTech and BSBA cohorts (*p* = 0.981).

Table 6. Dwass-Steel-Critchlow-Fligner (DSCF) post-hoc pairwise comparisons for marine biodiversity awareness

Pairwise Comparison	W	p-value	Significance
BEEd vs. BIndTech	-4.120	0.010	Significant
BEEd vs. BSBA	-4.112	0.010	Significant
BIndTech vs. BSBA	-0.267	0.981	Not Significant

These post-hoc findings highlight a distinct "Curricular Divide" within the institution. The BEEd program, which inherently integrates pedagogy, general sciences, and social responsibility into its training for future educators, successfully fosters a higher baseline of environmental awareness through its courses, to mention – environmental education as one of the program’s professional education courses. In stark contrast, the highly technical (BIndTech) and corporate-focused (BSBA) programs leave their students with an identical, lower baseline of marine biodiversity awareness.

This statistical confirmation elevates a key recommendation of this study: environmental literacy initiatives, such as SDG 14 integration, cannot be left solely to general education or pedagogy-based programs. To build campus-wide environmental stewardship, targeted interventions must be designed specifically for business and technology curricula, bridging the gap between their specialized fields and local marine conservation efforts (Fauzi & Fatmawati, 2025; Husamah et al., 2025; Werdianto et al., 2025).

To determine the relational dynamics between students' cognitive awareness and their affective disposition toward marine biodiversity, a Spearman’s rank-order correlation was conducted. The results, presented in Table 7, reveal that all sub-constructs are positively and significantly correlated ($p < .001$), indicating that environmental knowledge and pro-conservation attitudes are highly interdependent among the student population.

Table 7. Spearman’s rank correlation matrix of marine biodiversity self-perceived knowledge and understanding (perception of familiarity) and attitudes & values (environmental disposition)

Spearman	1	2	3	4	5	6
1. Fundamental Concept Familiarity	1					
2. Academic & Policy Awareness	0.641	1				
3. Research & Competency	0.537	0.595	1			
4. Conservation Values & Concern	0.706	0.687	0.414	1		
5. Perceived Institutional Engagement	0.603	0.795	0.656	0.622	1	
6. Proactive Intent & Willingness	0.570	0.602	0.543	0.568	0.615	1

Note: N = 383. Values represent Spearman's rho $p < .001$. All correlations are statistically significant.

Several critical patterns emerge from this matrix that contextualize the students' environmental engagement:

1. The "Institutional Driver" Effect

The strongest correlation in the entire study exists between *Academic & Policy Awareness* and *Perceived Institutional Engagement* ($\rho = 0.795$, $p < .001$). This very strong relationship confirms the "passive awareness" hypothesis discussed earlier: students' awareness of local policies and academic concepts is almost entirely tethered to how much the institution engages with the topic. It implies that students rely heavily on the university to drive their environmental literacy; if the institution does not actively discuss or provide opportunities for marine biodiversity research, the students' policy awareness may be proportionally associated.

2. The Knowledge-Value Connection

A strong positive correlation was observed between *Fundamental Concept Familiarity* and *Conservation Values & Concern* ($\rho = 0.706$, $p < .001$). This validates the foundational premise of environmental education: cognitive understanding directly may be associated to affective concern. Students who are highly familiar with marine ecosystems and SDG 14 are significantly more likely to value marine resources for local livelihoods and express deep concern for their conservation.

3. Validating the "Advocacy Gap"

Interestingly, the weakest correlation in the entire matrix is between *Research & Competency* and *Conservation Values & Concern* ($\rho = 0.414$, $p < .001$). While still statistically significant, this moderate relationship is the "missing link" in the science-to-policy pipeline. It quantitatively proves the "Advocacy Gap" identified in the descriptive statistics: a student's high level of environmental concern does not strongly guarantee their perceived competency to conduct research or communicate findings to policymakers. They possess the "heart" for conservation, but the technical "skills" for policy communication remain somewhat disconnected from their values.

4. Predictors of Proactive Intent

Proactive Intent & Willingness showed consistent, strong correlations with all other variables, most notably with *Perceived Institutional Engagement* ($\rho = 0.615$) and *Academic & Policy Awareness* ($\rho = 0.602$). This suggests that a student's willingness to actively seek information and participate in research-policy projects may be best nurtured through formal academic exposure and visible institutional support, rather than just foundational knowledge alone.

Qualitative Findings

Perceived Barriers and Opportunities

This section addresses the third research question regarding the perceived barriers and opportunities in translating academic research on marine biodiversity into local policy. To ensure methodological rigor and avoid impressionistic reporting, the open-ended survey responses ($N = 383$) were analyzed using a thematic analysis framework (Clarke & Braun, 2017). This involved iterative cycles of generating open codes from raw participant statements, grouping these into axial categories, and defining four overarching themes.

Perceived Barriers: The Architecture of Disconnection

Students perceive the failure to translate research into policy as a system of mutually reinforcing communicative and institutional barriers that may limit the institution's impact in Bagac, Bataan.

Theme 1: Structural and Communicative Barriers

The severe frictions in information flow and the absence of relational platforms between the university and local government.

- **Academic-Policy Language Disconnect:** Students overwhelmingly pointed to the challenge of overcoming technical jargon and the demand for more digestible research formats. The academic literature was viewed as inherently inaccessible. As one participant explicitly noted, *"Technical language barrier – Academic research is often written in complex, jargon-heavy formats."* Consequently, students emphasized the need for *"translating research into clear, accessible formats."*
- **Relational and Platform Deficits:** Beyond language, students identified a structural absence of cross-sector dialogue. One respondent highlighted the *"lack of knowledge exchange platforms – Few regular forums exist for scientists and policymakers,"* while another succinctly summarized that research fails to translate because *"it lacks regular collaboration, resources, and community involvement."*

Theme 2: Socio-Economic and Resource Constraints

Participants also demonstrated a pragmatic understanding of the external realities and resource scarcities that constrain conservation efforts.

- **Societal Priorities and Discourse Gaps:** Students noted that *"low public awareness"* and poor stakeholder communication heavily impact policy uptake. They acknowledged that the *"consideration of socio-economic factors"* often overrides ecological concerns, highlighting that *"there is a challenge in communication between researchers and policymakers."*
- **Resource and Infrastructure Deficits:** Internally and externally, students cited *"issues like limited funding"* and a general *"lack of support."* They recognized that bridging the gap requires physical and financial backing, noting the critical need for *"developing infrastructure"* to support these initiatives.

Perceived Opportunities: A Strategic Framework for Engagement

In direct response to the identified barriers, students envisioned a clear, multi-layered framework for transforming BPSU into a vital hub for local marine conservation.

Theme 3: Strategic Pathways for Collaborative Governance

To bridge the communication chasm, students proposed concrete mechanisms for knowledge translation and network building.

- **Capacity Building for Policy Translation:** Students identified that the most effective strategy *"is to improve how research is communicated."* Practical suggestions included requests for the university to *"offer workshops on turning research into policy briefs."* They argued that institutions must *"simplify research, train in policy writing, and work with local leaders."*
- **Multi-Stakeholder Network Integration:** Students emphasized the need to formalize LGU partnerships and integrate the campus with the broader community. One participant advised that bridging the gap requires *"stronger collaboration between scientists and policymakers, along with clear, actionable insights tailored to local needs,"* directly addressing the *"limited accessibility in the community."*

Theme 4: Institutionalizing Campus-Based Environmental Agency

Reflecting their reliance on institutional support, a significant portion of the data focused on how BPSU must embed environmental agency into the student experience.

- **Pedagogical and Institutional Commitments:** Students called for guidance from the faculty to *"integrate marine topics into the curriculum"* and *"encourage research projects or theses focused on coastal communities."* At the system level, there were strong calls to implement *"sustainable campus policies"* and specifically to *"establish a campus marine biodiversity center to drive research, advocacy, and sustainable practices."*
- **Student-Led Experiential Advocacy:** Finally, students expressed a strong desire to lead experiential initiatives. Suggestions ranged from organizing *"interactive, hands-on activities, like coastal clean-ups"* to leveraging digital advocacy by *"using posters and media to highlight local marine [life]"* and *"sharing ocean facts on social media."* To sustain this, participants heavily supported the *"formation of marine conservation clubs or societies that can lead beach cleanups, citizen science projects, or advocacy initiatives."*

Conclusion

This study establishes that while higher education students in Bagac, Bataan, possess strong theoretical awareness and affective concern for marine biodiversity, a critical "translational gap" prevents this awareness from evolving into policy engagement. Empirically, the data reveals a pronounced skill-gap paradox: although students highly value ecological research, an overwhelming 86.9% have never participated in marine biodiversity studies, reporting low competency in communicating findings to policymakers. Furthermore, a statistically significant curricular divide demonstrates that environmental literacy remains siloed, with pedagogy-based programs (BEEd) exhibiting significantly higher awareness than technical (BIndTech) and corporate-focused (BSBA) tracks. Qualitatively, these quantitative deficits are explained by an architecture of disconnection, characterized by an academic-policy language barrier and a severe lack of collaborative platforms between the institution and the Local Government Unit (LGU). Significantly, the strong correlation ($\rho = 0.795$) between perceived institutional engagement and academic policy awareness confirms that student initiative is heavily reliant on top-down institutional support.

Based on these data-driven findings, it is recommended that higher education institutions in coastal municipalities transition from being primarily providers of theoretical environmental education to active facilitators of collaborative governance. To bridge the observed curricular divide, foundational environmental courses—particularly those aligned with Sustainable Development Goal 14—could be integrated systematically across all academic disciplines to establish a uniform baseline of ecological stewardship. Furthermore, addressing the specific barriers identified by the participants requires implementing targeted, capacity-building interventions. Local state universities can foster this by providing formal training in translating complex academic research into accessible policy briefs, co-designing applied environmental projects directly with Local Government Units (LGUs), and developing dedicated collaborative platforms, such as the student-proposed campus marine biodiversity centers.

While these insights provide a framework for localized environmental advocacy, certain limitations must be acknowledged. The study's reliance on a cross-sectional design within a single-institution context, alongside self-reported survey data, limits the broad generalizability of the findings. Future research should expand this inquiry to multiple coastal state universities to determine if these translational barriers are systemic across higher education institutions in the Philippines. Additionally, longitudinal studies are recommended to evaluate the actual impact of integrating SDG 14 into non-pedagogical curricula and to measure the real-world efficacy of student-developed policy briefs on local marine governance.

Acknowledgment

The author expresses sincere appreciation to Joyce M. Bugay for her invaluable encouragement and support throughout the completion of this study. The author also extends deep gratitude to the undergraduate student participants for their time and insights, and to the course instructors of Bataan Peninsula State University – Bagac Campus who graciously assisted in the dissemination of the survey instrument.

Funding Statement

This research received no external funding.

Conflicts of Interest

The author declares that there is no conflict of interest regarding the publication of this paper.

CRediT authorship contribution statement

Z. L. Avelino: Conceptualization, methodology, investigation, formal analysis, data curation, writing – original draft, writing – review & editing, visualization, and project administration.

Declaration of the use of AI

During the preparation of this manuscript, the author utilized Google's Gemini solely as a language assistant to refine and rephrase the English text within the Results and Discussion chapter. The author independently designed the study, collected the data, and conducted all quantitative analyses and qualitative coding. The author thoroughly reviewed and edited all AI-assisted text and takes full responsibility for the final content and conclusions of the study.

Data availability statement

All relevant aggregated data supporting the findings of this study are presented within the article. To strictly protect the privacy and confidentiality of the participants, all raw individual datasets are restricted and not publicly available.

References

Avelino, Z. L. (2025). Evaluating science readiness of pre-service elementary teachers through diagnostic assessment and parental feedback: implications for teacher education. *Integrated Science Education Journal, 6*(3), 185-192. https://doi.org/10.37251/isej.v6i3.2133

Avelino, Z. L. (2025). Learning the concept of genes, DNA, and chromosome through developed virtual laboratory website. *JPBI (Jurnal Pendidikan Biologi Indonesia)*, *11*(1), 399-405. https://doi.org/10.22219/jpbi.v11i1.39774

Bemis, K. E., Girard, M. G., Santos, M. D., Carpenter, K. E., Deeds, J. R., Pitassy, D. E., Flores, N. A. L., Hunter, E. S., Driskell, A. C., Macdonald, K. S., Weigt, L. A., & Williams, J. T. (2023). Biodiversity of Philippine marine fishes: A DNA barcode reference library based on voucher specimens. *Scientific Data*, *10*(1), 411. https://doi.org/10.1038/s41597-023-02306-9

Binobo, G., Bradshaw, B., & Chowdhury, A. (2024). Scoping review of marine fisheries governance in the Philippines: Goals, instruments, actions, opportunities and challenges. *Regional Studies in Marine Science*, *80*, 103870. https://doi.org/10.1016/j.rsma.2024.103870

Bouchet, P., Decock, W., Lonneville, B., Vanhoorne, B., & Vandepitte, L. (2023). Marine biodiversity discovery: the metrics of new species descriptions. *Frontiers in Marine Science*, *10*. https://doi.org/10.3389/fmars.2023.929989

Clarke, V., & Braun, V. (2017). Thematic analysis. *The Journal of Positive Psychology*, *12*(3), 297-298. https://doi.org/10.1080/17439760.2016.1262613

Dalongeville, A., Nielsen, E. S., Teske, P. R., & von der Heyden, S. (2022). Comparative phylogeography in a marine biodiversity hotspot provides novel insights into evolutionary processes across the Atlantic-Indian Ocean transition. *Diversity and Distributions*, *28*(12), 2622–2636. https://doi.org/10.1111/ddi.13534

Davis, R. J., Albelda, R. L., Biondi, P., Hardianto, E., Huang, S., Diego Masucci, G., Lyn Sayco, S. G., Boo Wee, H., & Zhu, Y. (2022). Literature review of coral reef restoration in and around the coral triangle from the viewpoint of marine biodiversity. *Especial Labomar*, *55*, 413–431. https://doi.org/10.32360/78183

Deutsch, C., Penn, J. L., & Lucey, N. (2025). Climate, oxygen, and the future of marine biodiversity. *Annual Review of Marine Science, 16,* 217–245. https://doi.org/10.1146/annurev-marine-040323-095231

Dionisio, M., Mendes, M., Fernandez, M., Nisi, V., & Nunes, N. (2022). Aqua: Leveraging citizen science to enhance whale-watching activities and promote marine-biodiversity awareness. *Sustainability (Switzerland)*, *14*(21). https://doi.org/10.3390/su142114203

Elyza, S. R., Augusto, P. P., & Rollyn, M. D. (2024). Synthesizing the ecological and societal ramifications of environmental stressors on Philippine marine ecosystems: A comprehensive literature review. *International Journal of Current Science Research and Review, 7*(5), 2541-2547. https://doi.org/10.47191/ijcsrr/V7-i5-13

Fasola, E., Santolini, C., Villa, B., Zanoletti, A., Magni, G., Pachner, J., Stefani, F., Boldrocchi, G., & Bettinetti, R. (2025). Integrating traditional and innovative monitoring approaches to monitor the marine biodiversity in the Tyrrhenian Sea (Mediterranean sea). *Marine Environmental Research*, *208*. https://doi.org/10.1016/j.marenvres.2025.107160

Fauzi, A., & Fatmawati, D. (2025). AI Integration in green labs to achieve the third SDG goal: Literature review on good health and well being. *Green and Tropical Laboratory for Sustainability, 2*(2), 76-82. https://doi.org/10.22219/gtlabs.v2i2.43425

Garcia, A. A., & Anticamara, J. A. (2023). *Current estimates of Philippine marine mollusks taxonomic diversity*. Marine Species. https://www.marinespecies.org/

Huang, W. C., Evacitas, F. C., Balisco, R. A., Nañola, C. L., Chou, T. K., Jhuang, W. C., Chang, C. W., Shen, K. N., Shao, K. T., & Liao, T. Y. (2023). DNA barcoding of marine teleost fishes (Teleostei) in Cebu, the Philippines, a biodiversity hotspot of the coral triangle. *Scientific Reports*, *13*(1), 14867. https://doi.org/10.1038/s41598-023-41832-9

Husamah, H., Rahardjanto, A., Permana, T. I., Shukri, A. A. M., Olur, B., & Latifa, R. (2025). The urgency of green laboratory for sustainability: Review from Scopus AI data. *Green and Tropical Laboratory for Sustainability, 2*(2), 42-57. https://doi.org/10.22219/gtlabs.v2i2.40734

Kavanaugh, M. T., Bell, T., Catlett, D., Cimino, M. A., Doney, S. C., Klajbor, W., Messié, M., Montes, E., Muller-Karger, F. E., Otis, D., Santora, J. A., Schroeder, I. D., Triñanes, J., & Siegel, D. A. (2021). Satellite remote sensing and the marine biodiversity observation network: Current science and future steps. *Oceanography, 34*(2), 62–79. https://doi.org/10.2307/27085039

Lotze, H. K. (2021). Marine biodiversity conservation. *Current Biology*, *31*(19), R1190–R1195. https://doi.org/10.1016/j.cub.2021.06.084

Magris, R. A., Costa, M. D. P., Ferreira, C. E. L., Vilar, C. C., Joyeux, J. C., Creed, J. C., Copertino, M. S., Horta, P. A., Sumida, P. Y. G., Francini-Filho, R. B., & Floeter, S. R. (2021). A blueprint for securing Brazil's marine biodiversity and supporting the achievement of global conservation goals. *Diversity and Distributions*, *27*(2), 198–215. https://doi.org/10.1111/ddi.13183

Marriott, S. E., Cox, C., Amolo, R. C., Apistar, D., Mancao, R. H., & de Mutsert, K. (2021). Implications of community-based management of marine reserves in the Philippines for reef fish communities and biodiversity. *Frontiers in Marine Science*, *8*, 731675. https://doi.org/10.3389/fmars.2021.731675

Mecha, N. J. M., Vicente, J. A., Divine, G., Cayabo, B., Omar, S. M., Ducado, J. S., Cleto, J. E., Abrea, V. T., Daño, J. C., & Creencia, L. A. (2022). Success indicators of marine protected areas in the Philippines: A systematic review. *Ecocycles, 8*(1), 73–85. https://doi.org/10.19040/ecocycles.v8i1.218

Meyer, A. S., Pigot, A. L., Merow, C., Kaschner, K., Garilao, C., Kesner-Reyes, K., & Trisos, C. H. (2024). Temporal dynamics of climate change exposure and opportunities for global marine biodiversity. *Nature Communications*, *15*(1), 5836. https://doi.org/10.1038/s41467-024-49736-6

Mugnai, F., Meglécz, E., Costantini, F., Abbiati, M., Bavestrello, G., Bertasi, F., Bo, M., Capa, M., Chenuil, A., Colangelo, M. A., De Clerck, O., Gutiérrez, J. M., Lattanzi, L., Leduc, M., Martin, D., Matterson, K. O., Mikac, B., Plaisance, L., Ponti, M., … Wangensteen, O. S. (2021). Are well-studied marine biodiversity hotspots still blackspots for animal barcoding? *Global Ecology and Conservation*, *32,* e01909. https://doi.org/10.1016/j.gecco.2021.e01909

Roleda, M. Y., & Benayahu, Y. (Eds.). (2024). *The Philippine seas: Biodiversity and ecological impacts of natural and anthropogenic stressors in tropical reef systems*. Frontiers Media SA. https://www.frontiersin.org/research-topics/16133/the-philippine-seas-biodiversity-and-ecological-impacts-of-natural-and-anthropogenic-stressors-in-tropical-reef-systems/magazine

Tolochko, P., & Vadrot, A. B. M. (2021). The usual suspects? Distribution of collaboration capital in marine biodiversity research. *Marine Policy*, *124,* 104318. https://doi.org/10.1016/j.marpol.2020.104318

Valsecchi, E., Arcangeli, A., Lombardi, R., Boyse, E., Carr, I. M., Galli, P., & Goodman, S. J. (2021). Ferries and environmental DNA: Underway sampling from commercial vessels provides new opportunities for systematic genetic surveys of marine biodiversity. *Frontiers in Marine Science*, *8,* 704786. https://doi.org/10.3389/fmars.2021.704786

Werdianto, M., Yuliastuti, N., & Budiharjo, M. A. (2025). Information technology-based waste management at the Sukoharjo Pati landfill with an importance performance analysis approach. *Green and Tropical Laboratory for Sustainability, 2*(1), 10-17. https://doi.org/10.22219/gtlabs.v2i1.38857