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IDENTIFYING DIRECT THREATS TO AN INLAND WETLAND AND ITS AVIFAUNA: THE CASE OF CANAREM LAKE, CENTRAL LUZON, PHILIPPINES

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ABSTRACT – Philippine wetlands are important sites for birds as the country lies along the East Asian-Australasian Flyway. Canarem Lake is an inland wetland located in the agricultural town of Victoria, Tarlac in Central Luzon. Direct pressures can lead to habitat degradation and biodiversity loss in the wetland, thereby making threat identification critical in shaping conservation action. In this research, key informants participated in a survey composed of Likert scale and open-ended questions to determine perceived direct threats to Canarem Lake and its avifauna. Mixed methods involving consensus measure and thematic analysis were used to analyze responses, and a focus group was conducted as an in-method triangulation of results. Quantitative results show that key informants perceive seven specific threats belonging to three anthropogenic threat classes as direct pressures to Canarem Lake avifauna. Recreational activities emerged as the top perceived threat in the ranked list, while fishing and farming were identified in the thematic analysis of responses. Focus group was done to reconcile and validate results, where participants concurred with the threats in the ranked list and revealed additional insights on the threats identified in the thematic analysis. Policy options and management regimes should be studied and explored to protect Canarem Lake and the avifauna therein.

Keywords: avifauna, consensus, inland wetland, threats

INTRODUCTION

Wetlands are among the most productive ecosystems, hosting high levels of floral and faunal diversity and providing innumerable ecosystem services (Bobbink et al 2006; Ong et al 2005). Wetlands are "areas where water is the primary factor controlling the environment and the associated plant and animal life" and "can include marine, estuarine, lacustrine, riverine, palustrine areas" (Ramsar Convention, 1971; Ramsar Convention Secretariat 2013). Since 1994, the Philippines has been a contracting party of the Ramsar Convention, an intergovernmental treaty which aims to conserve and sustainably manage wetlands of international significance as waterfowl habitat (van Weerd and van der Ploeg 2004).

The Philippines is endowed with productive and highly diverse wetlands (*e.g.*, mangrove areas, marshes, estuaries, and lakes) There are approximately 1, 083,000 hectares (ha) of wetland area in the

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Philippines (Baconguis et al 1990) with 577 identified inland wetland sites (DENR 2020). Despite this high number of wetlands in the country, only ten (10) wetlands are considered areas of international importance.

Philippine wetlands provide various ecosystem services including the provision of food, freshwater, water regulation and purification, climate regulation, and recreational services (Sespeñe et al 2016). Apart from these services, the Philippine wetlands also act as habitat for both endemic and migratory birds. In fact, the Philippine wetlands, especially those situated in the Central Luzon Region, serves as an important stopover site for migratory birds in the East Asian-Australasian Flyway (Yong et al 2021; Kasahara et al 2020). In the wetlands, avifauna have several ecological roles which includes their trophic positions, transport processes, and pest and disease control, to name a few (Yong et al 2021). As such, birds are critical to the structure and function of wetlands.

Several pressures threaten wetlands and their associated avifaunal diversity worldwide. These threats come in various combinations, with varying intensity and impact to the wetland and avifauna as well. Some of the threats that appear in literature include agricultural intensification, changes in paddy field management, intensive fishing, hunting, various forms of pollution, invasive and weed species, low government attention, land use/land cover changes, and climate change (Leisher et al 2022; Gibru et al 2021; Yong et al 2021; Bezabih et al 2021; Kasahara et al 2020; Lador and Seronay 2020; Harisha 2016; Lamsal et al 2014). In addition, Philippine wetlands and its biodiversity face tremendous issues such as land use conversion, industrial and agricultural contaminations, overexploitation, and climate change (Sespeñe et al 2016). However, these threats are locality-specific, and threat identification and assessment need to be undertaken contextually (Leisher et al 2022). Questionnaire surveys and key informants are helpful in identifying these threats (*e.g.*, Leisher et al 2022, Bezabih et al 2021; Gibru et al2021; Lador and Seronay 2020; Lamsal et al 2014).

Canarem Lake is a 116-hectare wetland in Central Luzon critical to bird migration (Sapnu 2018). The wetland lies within the geopolitical jurisdiction of the agricultural town of Victoria, Tarlac, in the central plains of Luzon (Rufo et al 2015). Canarem Lake is accessible via a dirt road off the Victoria-Licab Road, near the Tarlac-Nueva Ecija boundary. It is a marsh surrounded by agricultural lands, with Rio Chico River to its west as the nearest remarkable landform. An analysis of citizen science records in 2022 reported the presence of around 21,547 individuals of 94 species from 42 avifaunal families in the wetland including the migratory Black-winged stilt (*Himantopus himantopus*), Philippine-endemic and endangered Philippine duck (*Anas luzonica*), and several passerines, waterbirds, and raptors—an increase from the 27 species noted by the local government from 2013 to 2015 (Bajas et al 2022 and Rufo et al 2015).

Canarem Lake has gained minimal scientific attention despite its huge avifaunal importance. There are few existing literature highlighting the presence of agricultural and fishing activities including land ownership issues which must be considered in the conservation of the Canarem La (UPLB-CFNR 2017; DENR-Biodiversity Management Bureau 2016; Rufo et al 2015; Palis et al 2004). A survey of literature revealed a huge scientific research gap on the ecology and biodiversity of the wetland, despite the availability of a Critical Habitat Management Plan prepared by the Municipal Technical Working Group of LGU Victoria in 2015 (Rufo et al 2015). No limnological studies have been conducted in the area so far (Brillo 2015). Furthermore, there are no studies aimed at assessing the threats to the avifaunal species in the vicinity of Canarem Lake, which is deemed vital in conserving the wetland as a critical site for bird migration. Hence, to address this research gap, the present study was conducted. The current study aimed to (1) measure the consensus of key informants regarding the present perceived threats to wetland and avifauna of the Canarem Lake; (2) develop a ranked list of the identified perceived threats to wetland and avifauna in the area; and (3) analyze responses to open-ended questions for themes and consistency with

the consensus and ranked list. It is expected that the findings of the study will serve as inputs for various stakeholders (e.g., academe, government, and local community) to develop strategic actions that will promote Canarem Lake's sustainable conservation and management.

METHODOLOGY

Study Area

The research was conducted in the Canarem Lake, Victoria, Tarlac (Figure 1), approximately 70 km north of Manila City by land travel. Geographically, it lies around 120.70˚E and 15.60˚N. This is a wetland surrounded by agricultural areas serving as habitat and stopover of various avifaunal species.

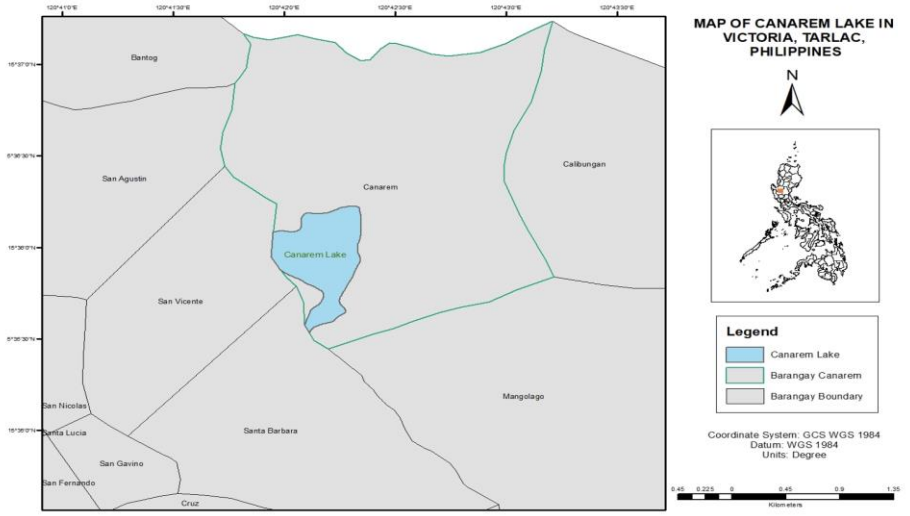

Figure 1. Map of Canarem Lake in Victoria, Tarlac, Philippines (Boundaries from 2020 Land Cover data of the DENR-NAMRIA).

An ocular visit to Canarem Lake was conducted in February 2021. This was followed by the data collection from key informants in May 23 and June 14 , 2022. Meanwhile, the focus group with 11 participants was conducted on January 18, 2023.

Research Instrument

A survey questionnaire was developed consisting of three (3) sections: 1) Respondent's Socio-demographic Profile, 2) Likert Scale Survey on Direct Threats, and 3) Open-ended Questions on Direct Threats. The Likert Scale Survey was based on and modified from the list of threats found in the International Union for the Conservation of Nature (IUCN) Threats Classification Scheme (version 3.2).

Expert Review and Pre-testing

Expert review is a frequently used and generally accepted pre-test to evaluate questionnaire methods (Ikart 2019). Prior to its deployment, the research instrument underwent validation and review from three (3) experts in the fields of biodiversity conservation and ecology. Comments from expert reviewers regarding the questionnaire wording and administration were considered to make necessary revisions. Methodologically, expert review can stand on its own as a pre-test for questionnaires (Ikart 2019). As a complement, a pre-test was done with a smaller sample size but coming from the same population as the targeted participants (Memon et al 2020; Nemoto and Beglar 2014). Given that the main sample is expected to be small considering the primary criteria of direct exposure and/or involvement with Canarem Lake, the instrument was pre-tested to only four participants. The small number of pre-test participants is compensated for by the fact that the instrument was already expert validated. No major changes to the instrument were deemed necessary after the pilot testing and the pre-test participants were included in the main sample given the limited number of possible respondents.

Key Informants

A total of fifteen key informants were selected using heterogeneous purposive sampling from the Municipal and Provincial Tourism Offices, Municipal Environment and Natural Resources Offices (MENRO), Municipal Councilor on Environmental Affairs, Barangay Captains of the proximate barangays (*i.e.*, Bantog, Canarem, and San Vicente), personnel of the Provincial and Community Environment and Natural Resources Office (DENR-PENRO-Tarlac, DENR-CENRO Capas) and birders who have visited Canarem Lake. The primary criterion used for determining the qualification of key informants was their direct exposure to and/or involvement with Canarem Lake.

Focus Group

In-method triangulation (Donkoh and Mensah 2023) was done through an unstructured focus group interview with 11 of the 15 key informants. The participants were primarily from the Victoria LGU and Provincial Tourism Office. This focus group was used as a triangulation method to reconcile results from the ranked list of threats and threats identified in the thematic analysis by feeding back results from the key informants (Caillaud and Flick 2017).

Data Analysis

Results from the survey were analyzed using appropriate tools. Socio-demographic characteristics were analyzed using frequency tables and descriptive statistics, when applicable. Meanwhile, the responses from the Likert scale were analyzed using consensus measure (Eq. 1) and severity indices (SI) (Eq. 2).

$$Cns(X) = 1 + \sum_{i=1}^{n} p_i log_2(1 - \frac{|X_i - \mu_X|}{d_X}) \quad \textbf{Eq.1}$$

where μ_X is the mean of X and d_x=$X_{max} - X_{min}$

$$SI = \frac{\sum_{i=0}^{4} b_i x_i}{4 \sum_{i=0}^{4} x_i} x100\% \quad \textbf{Eq.2}$$

where b_i= index of a class; constant expressing the weight given to a class;

x_i=frequency of response.

Consensus measure ranges from 0 to 1, with 0 indicating total absence of consensus, while 1 means perfect consensus (Tastle and Wierman 2007). For this study, the threshold for strong consensus measure is set at Cns(X)≥0.60, as used in previous studies (*e.g.* Khemiri et al 2022 and Powell et al *20*21). Meanwhile, the computed SI values were interpreted using the following index values (Bezabih 2021):

Table 1. Diagnostic table for the computed severity index value for each threat.

SI Value	Rating Classification
$\mathbf{0.00 \leq SI < 12.5}$	Strongly Disagree
$\mathbf{12.5 \leq SI < 37.5}$	Disagree
$\mathbf{37.5 \leq SI < 62.5}$	Neutral
$\mathbf{62.5 \leq SI < 87.5}$	Agree
$\mathbf{87.5 \leq SI < 100}$	Strongly Agree

All three measures (*i.e.*, consensus, mean, SI) were used hand in hand to produce the ranked list of perceived threats. The consensus measure was used to determine which threats are perceived similarly (Cns(X)≥0.60) by the participants. Meanwhile, the severity index was used to qualify and verbally describe the consensus of the key informants (*i.e.,* to see if they collectively agree, collectively disagree, or collectively take a neutral stance). Lastly, the mean was used as a numerical basis to rank the threats (*i.e.*, higher mean corresponds to a higher rank). In general, those included in the ranked list met the following criteria: 1) the category of the computed SI is equivalent to agree" or "strongly agree"; 2) there is apparent consensus based on the value set at Cns(X)≥0.60.

Open-ended questions were used to qualify the responses to the survey. Patterns in the responses were identified, reported, and analyzed using the thematic analysis framework in Braun and Clarke (2006). The six-phased framework involving 1) data familiarization, 2) initial codes generation, 3) theme search, 4) theme review, 5) theme definition, and 6) writing was adopted as described (Braun and Clarke 2006). Results of the thematic analysis were checked for consistency with the computed consensus and the developed ranked list, while considering scientific literature and/or field observations. Meanwhile, a focus group was conducted as a triangulation method.

RESULTS AND DISCUSSION

Socio-demographic profile of key informants

A total of 15 key informants responded to the survey instrument to identify their perceived threats to the avifauna and wetland of Canarem Lake. Table 2 summarizes the socio-demographic distribution of the key informants.

Table 2. Socio-demographic profile of key informants.

Characteristic	Category	Frequency	Percentage
Age	24-31	3	20.00
	32-39	1	6.67
	40-47	3	20.00
	48-55	3	20.00
	56-64	4	26.67
	Did not specify	1	6.67
Sex	Female	5	33.33
	Male	10	66.67
Place of Residence	Victoria Tarlac	10	66.67
	Outside Victoria, Tarlac	5	33.33
Educational Attainment	College Undergraduate	1	6.67
	College Degree Holder	12	80.00
	Graduate Degree Holder	2	13.33
Degree	STEM (Environment-Related)	2	13.33
	STEM (Non-Environment Related)	4	26.67
	Accountancy, Business, Management/ Humanities and Social Sciences	3	20.00
	Did Not Specify	6	40.00
Involvement	Government Employee/Official	11	73.33
	Birder/Bird Photographer*	3	20.00
	Lot Owner	1	6.67
Level of Involvement	Barangay/Community	3	20.00
	Municipal	6	40.00
	Beyond Municipal	4	26.67
	Non-Government/Lot Owner	2	13.33
Influence on Management	Private Citizen	1	6.67
	Management Staff	6	40.00
	Managers and Owner	8	53.33
Length of Involvement	<1 year	2	13.33
	1-3 years	6	40.00
	4-6 years	3	20.00
	>6 years	4	26.67

*Two are affiliated with a government office but chose to classify themselves as birders, given the nature of their involvement in Canarem Lake.

The mean age of the participants was 45 years old, with 24 as the lower limit and 64 as the upper limit. Noticeably, the majority came from the older age brackets. Those belonging to 48-55 and 56-64-year-olds accounted for a cumulative percentage of 46.67%, while only 26.67% came cumulatively from

those aged 24-31 and 32-39. Meanwhile, in terms of sex, males comprised 66.67% of the key informants. Key informants were also mostly from the municipality hosting the wetlands (66.67%).

Most of the participants finished tertiary education (80.00%). From those that specified their course, a significant number came from STEM programs (40.00%). However, only 13.33% or two earned STEM degrees directly related to the environment, namely BS Forestry and BS Agriculture. A considerable number (40.00%) also chose not to specify their undergraduate degree. Meanwhile, 13.33% or two (2) hold a graduate degree, both in Public Administration; one with a master's degree, the other a doctorate.

The involvement of the key informants to Canarem Lake was mostly in their capacity as government officials and employees (73.33%). Three are birders, while one is the lot owner inside the presently acknowledged extent of the Canarem Lake. Of the three birders, two are likewise affiliated with the Tarlac Provincial Tourism Office. However, they identified themselves as birders, perhaps considering the actual nature of their involvement in Canarem Lake (*i.e.*, taking photos of the birds for documentation and tourism purposes, on behalf of the Tourism Office).

In terms of the participants' level of involvement, 40.00% work at the Municipal Level, in the various units and offices of the Local Government of Victoria Tarlac (*i.e.*, Municipal Environment and Natural Resources Office (MENRO), Municipal Tourism Office, Office of the Municipal Mayor, Municipal Council). Meanwhile, a considerable number (26.67%) work outside the Municipality of Victoria such as the Provincial Government of Tarlac -Tourism Office, DENR-Provincial Environment and Natural Resources Office (PENRO) Tarlac, and the DENR-Community Environment and Natural Resources Office (CENRO) Capas. Participation from DENR Region III and the Conservation and Development Division were sought, but the request cascaded with the concerned CENRO. Furthermore, three informants (20.00%) were captains of the proximate barangays of Canarem Lake, namely Bantog, Canarem, and San Vicente. The rest include a non-government actor and the lot owner (13.33%).

More than half (56.67%) of the key informants may directly influence the management (*e.g.*, through execution and/or legislation in their capacity as government officials, or by mere exercise of rights as owner) of Canarem Lake. Meanwhile, 40.00% comes from the staff and administrative aides of the various government offices, directly exposed to Canarem Lake.

About 40.00% of informants have been involved with Canarem Lake in their various capacities for 1-3 years. Canarem Lake started to gain attraction as a birdwatching site around the same years, as evidenced by features in magazine shows, monitoring efforts by DENR, and citizen science uploads on eBird (Politiko 2019; Philippine Information Agency Region III 2019; and Bajas et al 2022). Those involved with Canarem Lake for more than six years form 26.67%, which particularly include the barangay captains and the lot owner. It is likewise interesting to note that those involved with the lake for 4-6 years (20.00%) are birders and employees from the Tourism Offices, one each at the municipal and provincial level.

Key informants' responses, measured consensus, and severity index

The means of the key informant responses are shown in Figure 2, with standard deviation values ranging from 0.74 to 1.48. From this, it can be inferred that the spread above or below the mean is noteworthy, given that changes in equivalent verbal descriptions in Likert scale occur at increments of 1. Hence, the mean, on its own, may not be reliable as the sole basis for interpreting the dataset given the dispersion of the data. Doing so may lead to erratic or lacking analysis. This justifies the need to use other measures such as severity indices (SI) and the consensus.

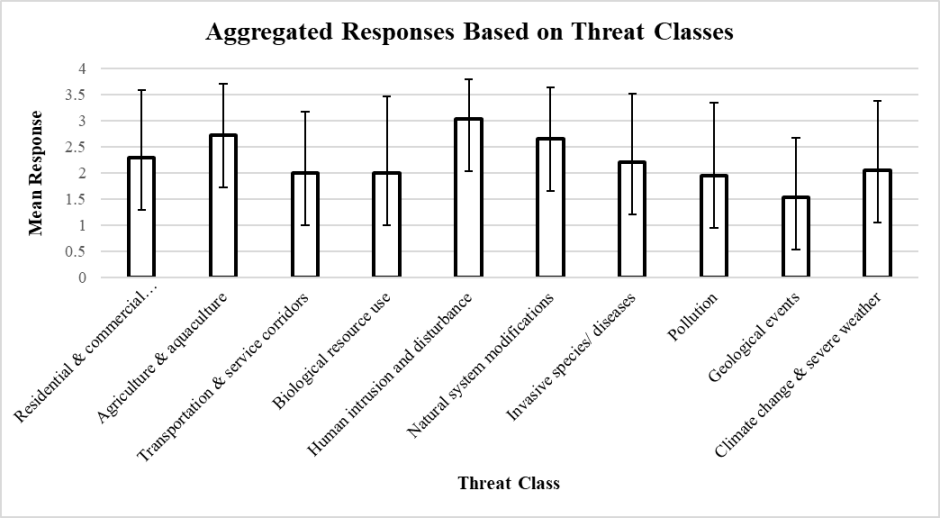

Figure 2. Key informant responses aggregated according to threat class.

Data, through the class mode, shows that the respondents exhibit a non-extreme response style (NERS). This is a tendency to systematically avoid the scale's extremes, resulting in responding using middle values of the scale (Liu et al 2017). In this case, there is an apparent avoidance of 0 or strongly disagree and 4 or strongly disagree, while preference for 1 or disagree and 3 or agree is apparent. It appears that gradations or inclusion of non-extreme options attract respondents who have only a slightly positive or negative attitude. Otherwise, in the absence of intermediate options, respondents might be forced to respond extremely or towards indifference (Weijters et al 2010). It is suggested that a 3-point Likert scale be used for clearer and easier consensus measures and to avoid NERS.

A threshold value of $Cns(x) \geq 0.60$ was set to determine which items were perceived as direct threats to the birds and wetland of Canarem Lake (Figure 3). Meanwhile, the severity index (SI) percentage provided a basis for the verbal description of the consensus of the key informants, as to their collective rating of the threat. Following these, only eight items met the criterion set. Of the eight, only five had the rating classification showing agreement ($62.5 \leq SI < 87.5$), indicative of shared mental models regarding the threats present in Canarem Lake while the rest were consensus on a neutral stance ($37.5 \leq SI < 62.5$).

The five threats agreed upon by consensus and as perceived by key informants include recreational activities, industrial aquaculture, work & other activities, small-holder farming, and abstraction of surface water for domestic use. Meanwhile, those that reached the set threshold value for consensus value but had a rating classification of neutral include utility & service line, earthquakes, and abstraction of ground water for commercial use. It is interesting to point out however, that for utility and service lines, more respondents registered agreement (*i.e.*, the mode is 3 which is equivalent to agree), but the computed SI can be classified as neutral.

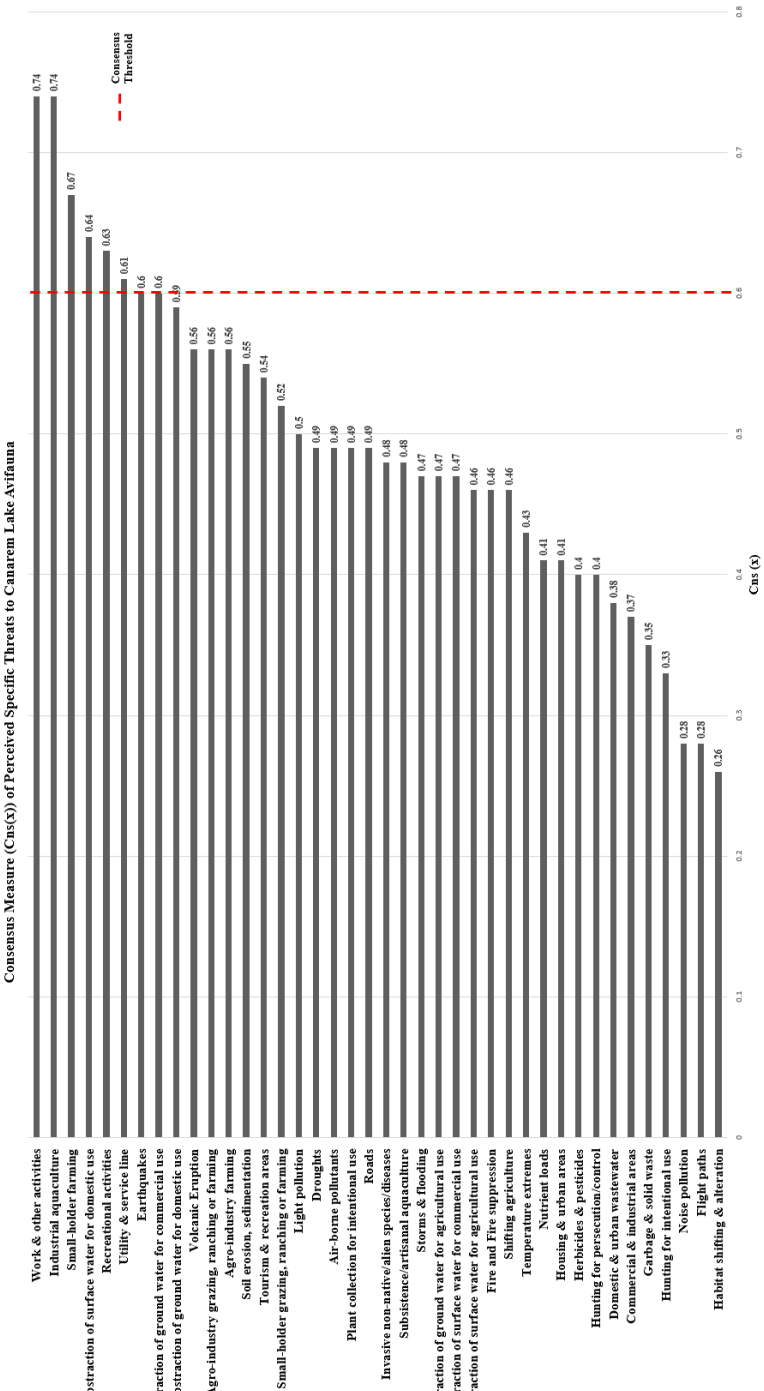

Figure 3. Consensus measure of perceived specific threats to Canarem Lake avifauna.

For the rest of the items, the lack of consensus may be assumed to be due to any of the following assumptions being unmet: 1) shared common culture among respondents; 2) independence of respondents; 3) questions are on a single topic and on the same level of difficulty (Stone-Jovicich et al *20*11). In the absence of a consensus, the agreement could either be fragmented (non-existent due to differences in individual mental models), multicentric (multiple group mental models), or weak (agreement but varying degrees) (Stone-Jovicich et al *20*11). These may be diagnosed following Stone-Jovicich (2011); however, this is already beyond the scope of this current work.

Developed ranked list of key informants' perceived threats

The consensus, mean, and severity index were used to develop the ranked list and to narrow down the perceived threats to Canarem Lake from ten to five threat classes (Table 5). In general, those included in the ranked list met the following criteria: 1) the category of the computed SI is equivalent to "agree" or "strongly agree"; 2) there is apparent consensus based on the value set at Cns(X)≥0.60. However, two noteworthy cases were considered for inclusion in the list. Abstraction of surface water for agricultural use and abstraction of groundwater for agricultural use both met the first criterion but failed to comply with the second criterion. Despite the lack of consensus, however, upon closer examination of responses, none of the key informants disagreed or strongly disagreed that these are indeed threats to the avifauna and wetland of Canarem Lake. This could mean that their agreement only varied in degrees (*i.e.*, weak agreement), but they nonetheless agreed. This is true only for these two cases; hence they were included in the list to be ranked.

Table 5. Ranked list of key informants' perceived threats based on Mean and Severity Index.

Rank	Perceived Threat	Mean	SI Category	Cns(X) ≥0.60	Threat Class
1	Recreational activities	3.14	Agree	Yes	Human intrusion & disturbance
2	Abstraction of surface water for agricultural use	3.07	Agree	No*	Natural system modifications
3	Industrial aquaculture	2.85	Agree	Yes	Agriculture & aquaculture
4	Work & other activities	2.78	Agree	Yes	Human intrusion & disturbance
5	Small-holder farming	2.71	Agree	Yes	Agriculture & aquaculture
5	Abstraction of groundwater for agricultural use	2.71	Agree	No*	Natural system modifications
7	Abstraction of surface water for domestic use	2.57	Agree	Yes	Natural system modifications

*Consensus value did not reach the threshold set by researchers, but face value examination shows that no respondent chose to disagree or strongly disagree. The computed Cns reflect moderate consensus (Powell et al 2021)

The mean was used as basis to arrive at the ranking reflected in Table 5. Interestingly, recreational activities were listed as the top threat to the wetland and the avifauna therein, even when the LGU and management actors are yet to formalize the ecotourism development in the area. This may indicate that the current informal and unregulated set-up is perceived to be unsustainable by the key informants, and as such this should be factored in by the LGU in their planning and establishment of an ecotourism program. Furthermore, the threats only come from three classes: 1) human intrusion and disturbance; 2) natural system modifications; and 3) agriculture and aquaculture. The same three classes also figured to be in the top 3 threats based on the computed mean, as shown in Table 3. It is noteworthy that 100.00% of the specific threats for class 1 were included in the ranked list, while it is 42.85% and 28.57%, respectively, for classes 2 and 3. All three are human originating and thus highlights the anthropogenic nature of the threats present in Canarem Lake. This is consistent with existing literature, especially for wetlands located in agricultural areas (Leisher et al 2022; Gibru et al 2021; Yong et al 2021: Bezabih et al 2021; Kasahara et al 2020; Lador and Seronay 2020; Harisha 2016; Lamsal et al 2014). Figure 4 shows observable activities in the wetland.

Figure 4. A) Birders and bird photographers in Canarem Lake; B) surface water being abstracted for agricultural use; C) rice farms adjacent to water bodies hosting Black-winged stilts (*Himantopus himantopus*); D) a fisherman on a boat in one of the water bodies in the wetland.

Thematic analysis of key informants' responses

Following the six-phased thematic analysis framework (Braun and Clarke 2006), the following themes were identified, and corresponding analysis were supplied. The results of the thematic analysis of the KII responses are summarized in Table 6.

When asked about the frequency of visits, two themes emerged from the responses of the key informants. Respondents from the PENRO – Tarlac and the Provincial Tourism Office of Tarlac reported visiting Canarem Lake two to three times per week during the birding season, which spans from October to March. In contrast, staff from the Local Government Unit (LGU) of Victoria indicated that they visit the lake even during the off-season, typically two to three times per month.

In terms of the purpose of their visit, the themes ranged from varied conservation purposes (*e.g.*, bird count, clean up, etc.), bird watching and photography, tourist guiding, among others. As expected, those living in the proximate barangays, which include the barangay captains and the lot owner, are most frequently exposed to the Canarem Lake. This should be factored in when planning the conservation of the wetland and the avifauna therein.

Table 6. Summary of identified themes from key informants' responses**.**

Theme	Responses
Frequency of visit	Seasonal (During birding season, 2-3 times per week) Off-season (2-3 times per month)
Reasons for visiting	Conservation Recreation (bird watching and photography) Tourist Guiding
Observed activities that could threaten avifauna	Fishing and Farming Birding and Grazing Hunting
Other threats	Presence of Invasive Species
Programs for lake and avifaunal protection	Awareness Raising Through IEC Campaigns Tree Planting Activities Policy Legislation Designation as Critical Habitat Utilization of Annual Bird Count as a Conservation Program

Fishing and farming were the top identified activities in Canarem Lake. Other activities mentioned include birding and grazing. In terms of destructive activities in the wetland that threaten the birds, agricultural intensification and destructive fishing practices emerged. Other activities with negative impact are hunting, in general and for subsistence, as well as the use of fire for agricultural and other purposes.

Farming, hunting, work and other activities, climate change, invasive species, fishing, grazing, or ranching, were identified as top threats from the list provided in the Likert scale section of the research instrument. However, the consensus-based top threat (*i.e.*, recreational activities) was not mentioned by the respondents. Meanwhile, farming, work and other activities, and fishing are included in the top threats in the ranked list. Interestingly, some respondents said that there were no threats currently to Canarem Lake and the avifauna therein, which appears to be inconsistent with the responses to the Likert scale items. One respondent also brought up the status of landownership as the top threat. This is not part of the original list of threats; however, this is a valid underlying or indirect threat that will impact the direction and success of avifauna and wetland conservation. Moreover, agricultural intensification through land conversion and excessive inputs of agrochemicals along with destructive fishing practices constantly appear in the thematic analyses, and this merits the attention of conservation and management actors of Canarem Lake. When left unchecked, these threats may have wide-reaching impacts on biodiversity, given the role of the wetland in bird migration and habitat provisioning to endemic and resident species.

In terms of the threats that respondents think are important to look out for, most were reiteration and/or specification of the listed threats in the Likert scale survey. This includes destructive fishing methods, use of screens and other forms of hunting techniques, agricultural intensification, and illegal wildlife trade, among others. One pointed out an underlying or indirect threat, which is the lack of government action in protecting the wetlands.

While the human-induced threats were most apparent, invasive species were likewise a recurrent theme in the responses. Informants use water lily and water hyacinth interchangeably to refer to an invasive macrophyte in the water bodies of the wetland. It can be assumed that the respondents are referring to the common water hyacinth (*Eichhornia crassipes*), the presence of which can be noted in the site, as seen in Figure 5. Non-native snails were likewise mentioned; in particular, the golden apple snail or kuhol (*Pomacea canaliculata*). The characteristic pink egg mass of *P. canaliculata* can likewise be seen in Figure 5. Other introduced snails in the wetland may include the invasive giant African land snail *(Achatina fulica*), as mentioned during the focus group discussions. Meanwhile, exotic tree species planted in the wetland have also been identified including the known invasive mahogany (*Swietenia macrophylla*) and the neem tree (*Azardiracta indica*). Janitor fish (*Pterygoplichtys* spp.) and cane toad (*Rhinella marina*) were also listed as invasives present in the wetland. Interestingly, domesticated animals were likewise mentioned generally, with a specific mention of sheep (*Ovis aries*). Perhaps this is in reference to the grazing animals in the area, among other domesticated fauna. Biodiversity studies should be undertaken to properly identify, record, and manage species that are known to be invasive.

It appears that negative impacts on bird ecology (e.g. feeding behavior) and the wetlands were the criteria used by the respondents to say whether a species is invasive or has become pestilent, as in the case of water hyacinth. Meanwhile, the ecology of the wetland is also seen as negatively impacted by invasive species, as they threaten native species and may cause disturbance to the natural functioning of the ecosystem (Dick et al 2017). Further ecological studies should be done to measure the actual impacts of these species. Although invasive species are not among the top perceived threats based on consensus, conservation actors should keep a close watch given that invasive species are recognized as among the primary drivers of biodiversity loss.

Among those identified programs to protect Canarem Lake and the avifauna therein are information, education, and communication (IEC) efforts on the avifauna, tree planting activities, and implementation of national laws prohibiting hunting. Legislation of local ordinances prohibiting hunting and construction inside the wetland, and the designation of the area as 'critical habitat' were likewise

Figure 5. Presence of common water hyacinth (*Eichhornia crassipes*) and the prominent pink egg mass of the golden apple snail (*Pomacea canaliculata*) (pointed by an arrow) in Canarem Lake.

mentioned, along with multi-sector and/or multi-stakeholder cooperation. Interestingly, only one respondent saw the annual bird count as a conservation program. These programs are mostly government-initiated, revealing the necessity of the recommended multi-stakeholder cooperation.

Triangulation through Focus Group

Triangulation is a process of seeking a more nuanced understanding of research findings to clarify disparate results by using different methods in dialogue with each other (Franc 2018). Feeding back selected results from interviews in focus groups with the interviewees as participants has been done in the context of triangulation (Caillaud and Flick 2017). Due to the seeming inconsistency of results from the quantitative and qualitative analysis of key informant responses, an in-method triangulation using a focus group was done. Of the previous 15 key informants, 11 were able to participate in the focus group, coming mostly from the Victoria LGU, Provincial Tourism Office, and birders.

When asked regarding the divergence of the results from the survey and open-ended questions, the participants generally expressed concurrence with the ranking of listed threats, of which recreational activities were the top. Participants raised their hesitation to explicitly mention recreational activities as threats in the open-ended question, thinking that this might serve as a basis for the complete halting of tourism in the area. Additional insights as to how recreational activities could negatively impact the avifauna and the wetland emerged. These include cases of littering from walk-in tourists who fail to coordinate with the LGU. Visiting bird photographers have also been noted by the participants to play bird

calls (call playback) for prolonged periods, which might impact the behavioral ecology of birds. It should be noted that call playbacks for purposes other than scientific research are discouraged by the Biodiversity Management Bureau (DENR-BMB 2017). Additionally, the focus group also centered on aquaculture-related activities and agricultural activities as threats to Canarem Lake. Participants occasionally narrated cases where nets for aquaculture trapped birds and ponds were converted to farming areas.

In terms of species perceived as invasive, the respondents added the presence of Acacia (*Samanea saman*) and Mango (*Mangifera indica)* among other trees. Taxa considered as 'invasive' by the focus group participants and key informants are summarized in Table 7, along with their invasive status based on available literature. All species mentioned are introduced or non-native, but invasiveness in the Philippines for some of these taxa should be verified through ecological studies.

Table 7. Summary of taxa considered by key informants as 'invasive' in Canarem Lake.

Common Name	Scientific Name	Invasiveness in the Philippines
Cane Toad	*Rhinella marina*	Harvey et al 2021
Giant African Land Snail	*Achatina fulica**	Yu et al 2024
Golden Apple Snail / Kuhol	*Pomacea canaliculata*	Joshi 2006
Janitor Fish	*Pterygoplichtys* spp.	Joshi 2006
Mahogany	*Swietenia macrophylla*	Baguinon et al 2005
Mango Tree	*Mangifera indica*	-
Neem	*Azardiracta indica*	-
Rain Tree / Acacia	*Samanea saman*	-
Sheep	*Ovis aries*	-
Water Hyacinth	*Eichhornia crassipes*	Joshi 2006

*Accepted name for *Achatina fulica* is *Lissachatina fulica* (MolluscaBase, 2024)

Moreover, management and policy measures were also discussed in the focus group. To address recreational activities as a threat, tourists' orientation and IEC materials distribution were brought up. For aquaculture, passing an ordinance prohibiting nets and designating areas and buffer zones for fishing was discussed. In terms of invasive species management, water hyacinth (*E. crassipes*) resurfaced in the focus group, with the participants adding that managing these involves collecting the plants to be turned into bags and other products. Coordination between municipal and barangay officials was deemed crucial by the participants in the protection of Canarem Lake and its avifauna.

Ultimately, the discussions returned several times to the land ownership issue as a limiting factor to the management and development options that can be implemented in the area. In line with this, participants from the Victoria LGU expressed intentions and plans to acquire Canarem Lake.

Additionally, the threats identified in this study are applicable to the wetland in general, but determination of species-specific threats may be necessary for taxon-based conservation. Given the perception-bated nature of the results of this study, other methods to quantify and assess threats empirically

should be explored.

CONCLUSION AND RECOMMENDATIONS

Recreational activities emerged as the top perceived threat by the key informants through consensus measures. Identified threats are notably anthropogenic, however, attention was drawn toward potential invasive species pressures in the area. Nevertheless, existing policies, programs, and plans of the LGU may not sufficiently address the identified threats from the ranked list, thematic analysis, and focus group discussion. This paper contributes to the scarce literature on threats affecting migratory bird species in stopover, wintering, or non-breeding sites. More importantly, it provides critical information on threats for conservation actors to monitor, control, and contextually address through further research, science-based policies, or environmental programs. Policy options and management regimes including pursuing a critical habitat status, protected area status, recognition as a Ramsar site, among other conservation paradigms should be explored. A multi-stakeholder monitoring and advisory group composed of members from the academe, government, local community, concerned citizens, and other sectors should be convened to guide the development and conservation of Canarem Lake.

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