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Dragonflies and damselflies (Insecta: Odonata) in Tram Chim National Park, Southern Vietnam: Updated species list and threats to their habitats

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Abstract

Published regional records are reviewed and their validity is analyzed. In total, thirty-five species of Odonata are recorded from Tram Chim National Park, southern Vietnam. In addition, threats from human land-use activities as rice production and shrimp farming to Odonata and proposals for appropriate conservation solutions are discussed.

Key words: Odonata, species, distribution, threats, Tram Chim National Park, southern Vietnam

Introduction

Situated in Dong Thap Province (southern Vietnam), Tram Chim National Park in the Mekong Delta (Tram = *Melaleuca* (Myrtaceae), Chim = birds; meaning in Vietnamese: A *Melaleuca* forest harbours many birds) is located 19 km to the east of the Mekong River. The topography of the National Park is flat, sloping slightly to the east. It is covered by distinctive habitat types such as closed evergreen broadleaf forests on acidic soils, seasonally flooded grasslands, and lotus - water lily communities. Prior to canalization, the Mekong plain was covered by reeds and seasonally flooded with standing water lasting for continuous periods of up to seven months per year. Since canalization, flood waters are drained more rapidly and the National Park now is flooded for less than six months per year. Water levels in the canals begin to rise in June, at the beginning of the rainy season. Between September and December, the National Park is inundated to a depth of 2 to 4 m, with a peak in October.

Among others, the region is famous and important as habitat of app. 10% of the world population of the globally endangered Sarus Crane (*Grus antigone* (Linnaeus, 1758)) (<https://datazone.birdlife.org/species/factsheet/sarus-crane-grus-antigone/text>). The Sarus Crane is the symbol of Tram Chim National Park. With an area of more than 7,313 hectares, this is the largest natural wetland ecosystem conservation area remaining in the Dong Thap Muoi (Plain of Reeds) region (Duong et al. 2021).

Since the mid-1980s, 53 km of dykes fitted with sluices have been constructed around the national park, with the aim of impounding flood water for longer as well as reducing the lowering of the water table during the dry season. The national park is fragmented by canals into five management zones (A1-5) (Fig. 1B); the water level of each can be managed separately.

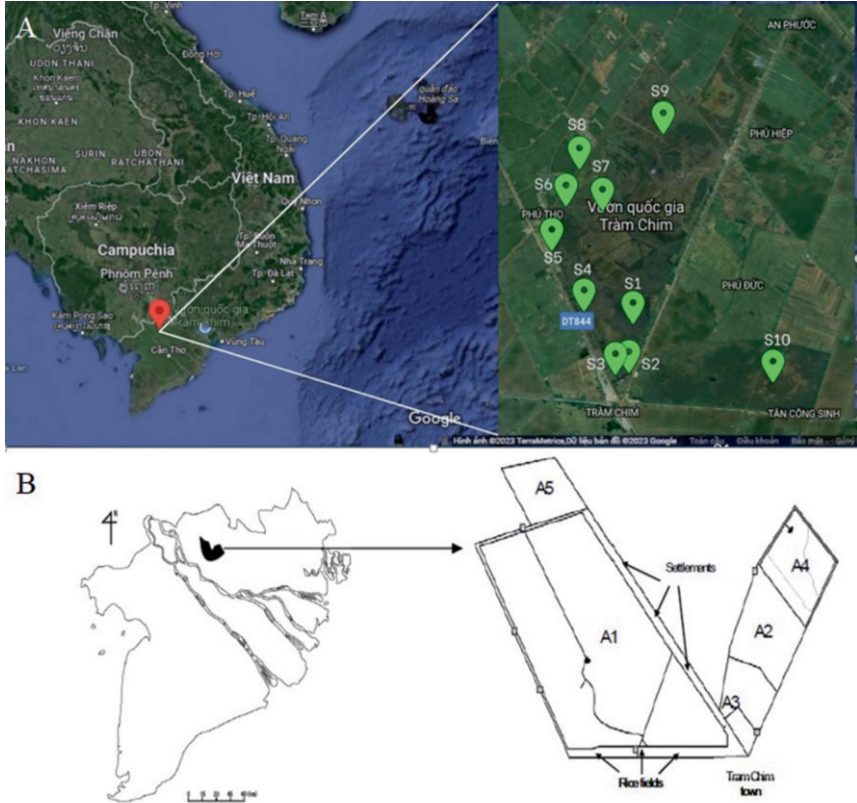


Figure 1: Map of Tram Chim National Park. (A), Collecting site; (B), Subdivision areas (re-arranged from Do 2007).

A regional history of odonate studies in Tram Chim National Park

Tran et al. (2002) first published a list of 10 odonate species from Tram Chim, which includes many misidentifications and taxonomic errors: *Matrona* sp., *Cercion hieroglyphium* (Brauer, 1868), *Cercion plagiosum* (Needham, 1930), *Ischnura lobata* Needham, 1929, *Indolestes peregrinus* (Ris, 1916), *Sympecma annulata* (Selys, 1887), *Acisoma panorpoides* Rambur, 1842, *Crocothemis servilia* (Drury, 1773), *Deiellia phaon* (Selys, 1883) and *Nannophya pygmaea* Rambur, 1842. This list is unreliable for two reasons: (1) Tran et al. (2002) identified these species based on larvae and (2), several species are taxonomically incorrect or do not occur

in the Vietnamese fauna. For example, *Cercion hieroglyphium* and *Cercion plagiosum* are no longer valid species names; *Ischnura lobata* (a synonym of *Ischnura asiatica* (Brauer, 1865)), *Indolestes peregrinus*, *Sympecma annulata* (an east-palaeartic species [= *Sympecma paedisca* Brauer (1877)]) and *Deiellia phaon* have also never been recorded in Vietnam; *Matrona* sp. and *Nannophya pygmaea* are mountainous species that cannot be found in the lowland wetland habitat in Tram Chim. Therefore, we do not list these species in this study except for two widespread species *Acisoma panorpoides* and *Crocothemis servilia*, which are likely distributed in Tram Chim National Park.

Subsequently, Dang (2008), in his master's thesis, published a list of 25 species of Odonata in Tram Chim. However, some species in this study were misidentified as follows: "*Orthetrum triangulare* (Selys, 1878)" in Figure 21 (page 13) is actually *Brachydiplax farinosa* (Krüger, 1902); "*Neurothemis fluctuans* (Fabricius, 1773)" in Figure 16 (page 12) is *Diplacodes nebulosa* (Fabricius, 1793) and the latter species was not mentioned in the list. We also confirm the occurrence of *D. nebulosa* in Tram Chim National Park in this study.

Finally, Trong et al. (2021) list 14 odonates from Tram Chim National Park. However, they did not provide any figures related to these species. Moreover, some species in Trong et al. (2021) are misidentifications such as *Matrona* sp., *Chlorogomphus* sp. and *Ophiogomphus* sp. since they are mountain dwelling species and certainly cannot be found in the lowland wetland habitat in Tram Chim.

Based on the results of our surveys and considering exclusively the reliable records from previous studies, below we list a total of 35 odonate species of Tram Chim National Park. We also provide a discussion of the threats to the habitats of dragonflies and damselflies by human activities around the buffer zone of the national park.

Field surveys & Collecting sites

We conducted many surveys from February 2023 to March 2024 at 10 sites (S = Site) throughout Tram Chim National Park (Figure 2). The surveys were conducted in the dry and rainy season as listed in Table 1.

Study sites	Rainy season (from May – Oct)	Dry season (from Nov – Apr next year)	No of Odonata taxa
S1		√	13
S2	√	√	22
S3	√	√	12
S4	√	√	11
S5	√	√	16
S6		√	10
S7		√	12
S8		√	13
S9		√	5
S10		√	10

Table 1: List of sample collection points according to rainy and dry seasons.

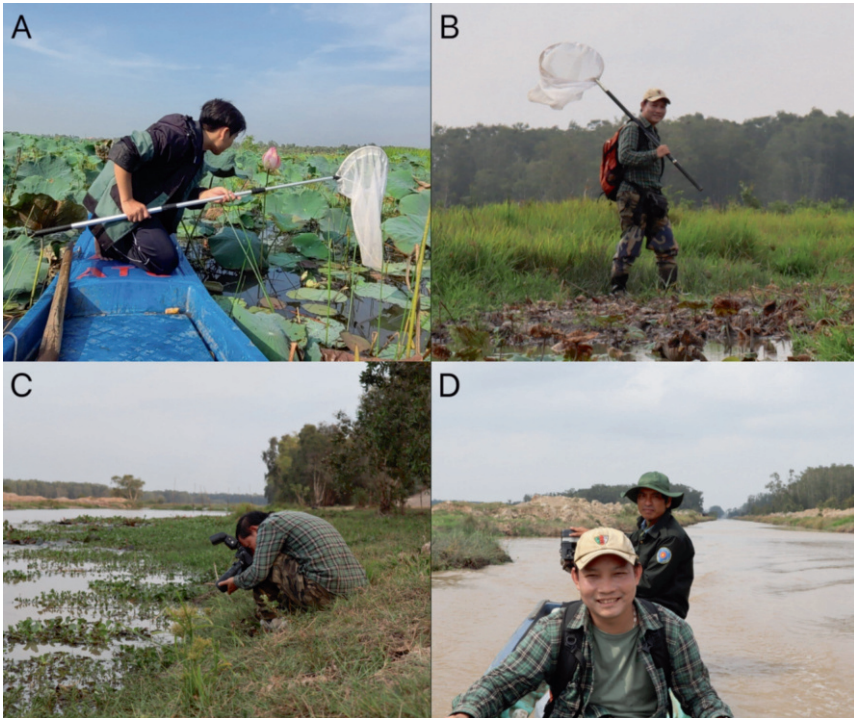


Figure 2: Author's field survey. (A), MKT collected samples at S3; (B), QTP at S7; (C), QTP took photos at S8; (D), Forest ranger assisted two authors to the collecting sites by motorboat.

Dissolved oxygen (DO) concentration in water were measured using a pH/EC/DO Multi-parameter Meter HI98194 at several direct discharge points in water canals adjacent to the National Park.

Collecting sites

- S1 (10.69363N, 105.54233E): This canal is located in the grassland area of subdivision A1 region of the park (Figure 3). Because it is in a low-lying location in the alum water-logged area, the pH is very low (fluctuating from 3-3.7 in the dry season (Duong et al. 2021)).
- S2 (10.68202N, 105.55611E): Subdivision A1. This place is a swamp area flooded all year round, covered quite tightly by the canopy of *Melaleuca* forest, located close to DT843 road (Figure 4).
- S3 (10.67979N, 105.55438E): Subdivision A1. This area is a seasonally flooded grassland, about 400m from C4 Ranger Station. During the rainy season, the water rises and during the dry season the ground is exposed (Figures 2, 5).



Figure 3. Survey site S1. *Rhyothemis phyllis* and *Ceriagrion cerinorubellum* are common in this habitat along a canal.



Figure 4. Survey site S2 where *Onychargia atrocyana* and *Zygomma petiolatum* were found.

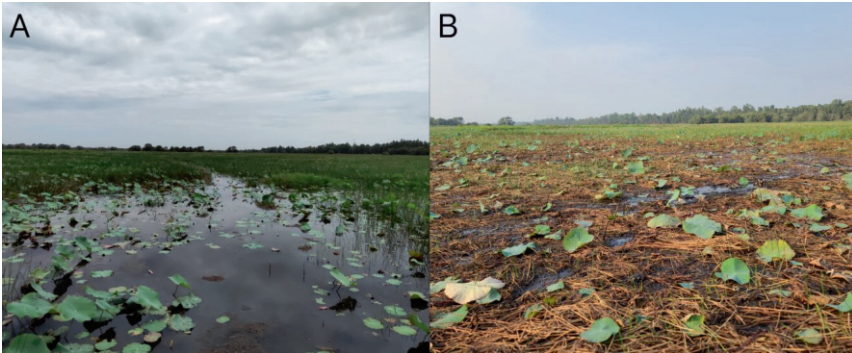


Figure 5. Survey site S3 with Lotus (*Nelumbo nucifera*) swamp in (A), rainy season & (B), dry season.

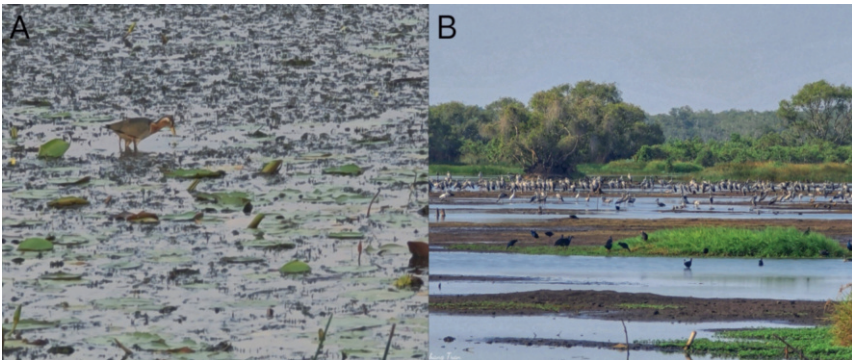


Figure 6. Survey site S4. (A), Aquatic vegetation grows in the rainy season with high water levels; (B), low water level in the dry season.

- S4 (10.68131N, 105.52799E): Subdivision A1. This site is located close to the main channel of the National Park and there is an exchange of water between the canal and the seasonally flooded grassland system (Figure 6).
- S5 (10.68413N, 105.50237E): Subdivision A1. The small creek next to the National Park dike was the only survey site with flowing water (Figure 7).
- S6 (10.69769N, 105.49173E): Subdivision A1. The area is relatively flat with lowlands that have residual water during the dry season (Figure 8).
- S7 (10.70792N, 105.50072E): Subdivision A1. This area has small creeks inside the grasslands that are seasonally flooded. In the dry season, the water recedes to reveal these creeks (Figures 2, 9).
- S8 (10.70957N, 105.48301E): Subdivision A1. The canal has tall grass on both sides (Figure 10).
- S9 (10.74230N, 105.49002E): Subdivision A1. This is one of the main moving canals in the National Park, with rows of large trees and grass on both sides (Figure 11).



Figure 7. Survey site S5, the only habitat surveyed with flowing water.



Figure 8. Survey site S6 in the dry season. Water concentrates in low-lying areas to form large water basins.



Figure 9. Survey site S7 in the dry season. The receding water exposed small creeks in the grassland area.



Figure 10. Survey site S8 in the dry season.



Figure 11. Survey site S9 in the dry season.



Figure 12. Survey site S10 in the dry season.

- S10 (10.72378N, 105.59012E): Subdivision A4. Transition area between *Melaleuca* forest and grassland (Figure 12). This is the traditional region within the National Park, where the Sarus cranes gather after returning from the breeding grounds.

Material and Methods

To accurately identify species to the species level for some easily confused species or species with a narrow distribution range, we collected specimens from 10:00 AM to 5:00 PM during survey sessions, using hand nets. After collection, the specimens were placed in paper bags for 12-24 hours to empty their bowels. Subsequently, the specimens were immersed in acetone solution for 8-12 hours, then removed and to the acetone will allowed to evaporate completely. The collection time and location were recorded (Bui et al., 2021).

Specimens that are easily confused were studied using a stereomicroscope to clearly visualize the structure of the anal appendages or genitalia. To identify the specimens, several published papers were consulted.

Results

Highly reliable Odonata species listed by Tran et al. (2002), Dang (2008) and Trong et al. (2021), were first selected, to which were added the 13 species collected by the authors in the framework of our field studies in 2023 and 2024. The result totaled to 35 species for Tram Chim National Park (Table 2).

Between February 2023 and March 2024, the following 13 species were added to the regional list (Table 2): *Aethriamanta aethra*, *A. brevipennis*, *Agriocnemis minima*, *Ceriagrion cerinorubellum*, *C. praetermissum*, *Onychargia atrocyana*, *Potamarcha congener*, *Pseudagrion rubriceps*, *P. williamsoni*, *Pseudocopteryx ciliata*, *Rhodothemis rufa*, *Urothemis signata* and *Zyxomma petiolatum*.

Photographs of the Odonata fauna in Tram Chim are shown in Appendices 1 and 2.

Notes about some Odonata species in Tram Chim National Park

Agriocnemis minima Selys, 1877

Figure 13 (A-B)

Kompier (2024) and Phan & Ngo (2023) reported *Agriocnemis minima* in Cat Tien National Park (Dong Nai Province) and Phu Quoc Island (Kien Giang Province) respectively. Here, we report the third record of this species in Vietnam. Males are characterized by a green-patterned body and mottled orange on the abdominal tip. Immature males have greenish markings on the head, thorax and abdomen with the abdominal tip in orange.

Ceriagrion auranticum (Fraser, 1922)

Both Dang (2008) and Trong et al. (2021) recorded *Ceriagrion auranticum* and *Ceriagrion indochinense* (Asahina, 1967) in Tram Chim. However, these species resemble each other and are easily misidentified. During our surveys, we have never collected *C. indochinense* but collected *C. auranticum* at several collecting sites. Therefore, we removed *C. indochinense* from the checklist of Odonata from Tram Chim.

Table 2: List of odonates species in Tram Chim National Park

No.	Species	Study sites	References
1	<i>Agriocnemis pygmaea</i> (Rambur, 1842)	S6	Dang (2008), Trong et al. (2021), this study
2	<i>Agriocnemis minima</i> (Selys, 1877)	S1-S10	This study
3	<i>Ceriagrion auranticum</i> (Fraser, 1922)	S1, S2, S7, S8	Dang (2008), Trong et al. (2021), this study
4	<i>Ceriagrion praetermissum</i> (Liefinck, 1929)	S1-S4, S6-S8	This study
5	<i>Ceriagrion cerinorubellum</i> (Brauer, 1865)	S1, S2	This study
6	<i>Ischnura senegalensis</i> (Rambur, 1842)	S2-S5, S7	Dang (2008), Trong et al. (2021), this study
7	<i>Pseudagrion microcephalum</i> (Rambur, 1842)	S1, S3-S5, S7	Dang (2008), this study
8	<i>Pseudagrion rubriceps</i> (Selys, 1876)	S5	This study
9	<i>Pseudagrion williamsoni</i> (Fraser, 1922)	S5	This study
10	<i>Onychargia atrocyana</i> (Selys, 1865)	S2	This study
11	<i>Pseudocopera ciliata</i> (Selys, 1863)	S2, S5	This study
12	<i>Anax guttatus</i> (Burmeister, 1839)	S5	Dang (2008), Trong et al. (2021), this study
13	<i>Ictinogomphus decoratus</i> (Selys, 1854)		Dang (2008), Trong et al. (2021)
14	<i>Aethriamanta aethra</i> (Ris, 1912)	S8	This study
15	<i>Aethriamanta brevipennis</i> (Rambur, 1842)	S5, S8	This study
16	<i>Acisoma panorpoides</i> (Rambur, 1842)	S1-S10	Dang (2008), this study
17	<i>Brachythemis contaminata</i> (Fabricius, 1793)	S1-S9	Dang (2008), Trong et al. (2021), this study
18	<i>Brachydiplax chalybea</i> (Brauer, 1868)	S1-S9	Dang (2008), Trong et al. (2021), this study
19	<i>Brachydiplax farinosa</i> (Krüger, 1902)		Dang (2008), this study
20	<i>Crocothemis servilia</i> (Drury, 1773)	S2, S5	Dang (2008), this study
21	<i>Diplacodes trivialis</i> (Rambur, 1842)	S6, S7, S10	Dang (2008), Trong et al. (2021), this study
22	<i>Diplacodes nebulosa</i> (Fabricius, 1793)	S3, S4, S10	Dang (2008), this study
23	<i>Neurothemis fluctuans</i> (Fabricius, 1773)	S2, S5, S8, S10	Dang (2008), this study
24	<i>Neurothemis tullia</i> (Drury, 1773)	S1-S2, S8	Dang (2008), this study
25	<i>Orthetrum pruinosum</i> (Burmeister, 1839)		Dang (2008)
26	<i>Orthetrum sabina</i> (Drury, 1770)	S2-S8, S10	Dang (2008), Trong et al. (2021), this study
27	<i>Potamarcha congener</i> (Rambur, 1842)	S2	This study
28	<i>Pantala flavescens</i> (Fabricius, 1798)	S1-S2, S10	Dang (2008), Trong et al. (2021), this study
29	<i>Rhyothemis phyllis</i> (Sulzer, 1776)	S1-S10	Dang (2008), this study
30	<i>Rhyothemis variegata</i> (Linnaeus, 1763)	S1-S8	Dang (2008), this study
31	<i>Rhodothemis rufa</i> (Rambur, 1842)	S1, S2, S10	This study
32	<i>Tholymis tillarga</i> (Fabricius, 1798)	S2, S10	Dang (2008), Trong et al. (2021), this study
33	<i>Trithemis pallidinervis</i> (Kirby, 1889)		Dang (2008)
34	<i>Urothemis signata</i> (Rambur, 1842)	S2, S3	This study
35	<i>Zyxomma petiolatum</i> (Rambur, 1842)	S2	This study



Figure 13. *Agriocnemis minima*. (A), male; (B), immature female (photographed in S3 by MKT).

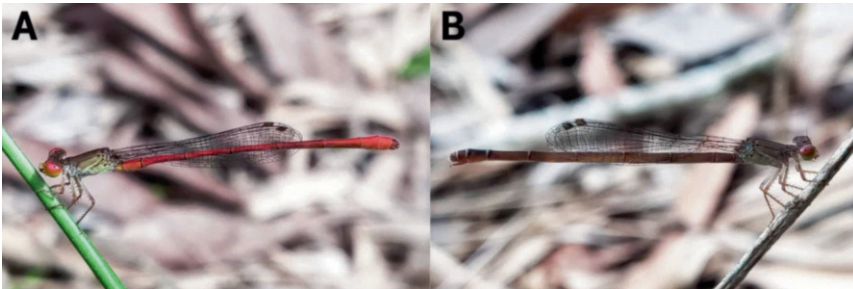


Figure 14. *Ceriagrion praetermissum*. (A), male; (B), female (photographed in S2 by MKT).



Figure 15. *Aethriamanta aethra*; (A), male; (B), immature male; (C), female (photographed in S8 by MKT).

Ceriagrion praetermissum (Lieftinck, 1929)

Figure 14 (A-B)

This is a new record for Tram Chim. *C. praetermissum* is documented on internet for some locations in southern Vietnam such as in Cat Tien National Park (Dong Nai Province) by Kompier (2024), U Minh Thuong National Park (Kien Giang Province) (<https://www.inaturalist.org/places/u-minh-th-ng>) and Sa Dec City (Dong Thap Province) by Anh Tuan Vo (2019) (<https://www.projectnoah.org/spottings/947620873>). Males have a reddish abdomen (Fig. 14A) while females have a dark brownish abdomen (Fig. 14B), and their anal appendages are characterized by the unique paraprocts divided into two processes in lateral view. Specimens mainly can be found in *Melaleuca* forests and grasslands along canals.

Aethriamanta aethra (Ris, 1912)

Figure 15 (A-C)

This species was first recorded in 2011 for Vietnam in U Minh Thuong National Park (Kien Giang Province) (<https://wildlifeatrisk.org/2019/01/29/new-dragonfly-species-for-vietnam/>), and later in Hanoi by Sebastien (2012). Kompier (pers. comm.) recorded it regularly in Cat Tien National Park between 2014 and 2016. Tram Chim National Park is the fourth locality for this species in Vietnam. Males are dark purple in color, their abdomen is black from the 7th abdominal segment, and the hind wing corners are black (Figure 15A). When immature, males are black with yellowish stripes as the females (Figure 15B-C). Females are mainly yellow with black streaks on synthorax, black hind wing corners and rows of yellow spots running along both sides of the abdomen (Figure 15C).



Figure 16. *Aethriamanta brevipennis*. (A), male; (B), immature male; (C), female (photographed in S8 by MKT).

From a regional point of view, they often perch on dry, open tree branches to rest or observe prey. Males also occasionally have been recorded flying out to grassland areas near water's edge or flooded grasslands.

Aethriamanta brevipennis (Rambur, 1842)

Figure 16 (A-C)

Notes. This small dragonfly was recorded in Hanoi City by Sebastien (2011), Van Long (Ninh Binh Province) by Guillon (2018), in Yok Don National Park and Ea H'leo District (Dak Lak Province) by the second author and in Cat Tien National Park (Dong Nai Province) by Kompier (2024). The species is characterized by small size body with short and broad bright red (male) and yellow (female) abdomen. The male synthorax is black with yellowish pattern; wings are hyaline with dark reddish edge at base of hindwing (Figure 16A). The female is brown-yellowish (Figure 16B-C). They also have a similar ecological behavior to *Aethriamanta aethra* and share the habitat with this species, often perching on fairly exposed tree branches to rest and observe prey.

Threats to the Ecosystem of Tram Chim National Park

Pollution from wastewater

The buffer zone of Tram Chim National Park has long seen the establishment of several fish farming households (Figure 17B). This economic model poses risks to the core zone of the National Park if not properly regulated. The current concern is the increasing eutrophication in certain water areas adjacent to Tràm Chim, causing pollution by wastewater effluents from the fish ponds (Figure 17A).

Measuring DO at two points showed low DO levels with 5.40 mg/L and 5.54 mg/L. Here, damselfly diversity was very low; in most cases, damselflies only were represented by *Agriocnemis minima* and *Ischnura senegalensis*, while dragonflies were absent.

Pollution from agricultural chemicals

Rice farming is a common and long-standing economic model in the Mekong Delta, including areas surrounding Tram Chim National Park. Current rice cultivation practices have caused many negative impacts on the environment, particularly pollution from agricultural chemicals. Surveyed rice cultivation areas often showed packaging and containers of pesticides (Figure 17C). Residual chemicals dissolve in the water, severely affecting aquatic organisms such as fish, frogs, and also dragonfly larvae (for example: Ishida & Murata 1992 or Nakaniishi et al. 2020). Surveyed inorganic rice paddies showed a very low diversity of dragonfly species, with dominating common species such as *Brachythemis contaminata*, *Orthetrum sabina*, and *Diplacodes trivialis*. Damselflies were absent from the irrigation canals in the surveyed paddies.

Improvement measures must be implemented to reduce environmental pollution, such as limiting and reducing the dosage of agricultural chemicals, replacing them with biological control methods or environmentally friendly organic rice farming.



Figure 17. Human production activities threaten the environment in the buffer zone of Tram Chim National Park. (A), Fish pond wastewater outflow pipe; (B), fish pond; (C), pesticide bottle; (D), dead fish due to polluted water; (E), wastewater from brackish water shrimp farming.

The problem of shrimp farming water supplies

Brackish water shrimp farming has emerged in the buffer zone of Tram Chim National Park in recent years (Figure 17E). Brackish shrimp farming requires drilling wells to extract saline water. According to interviews with farm owners, shrimp only thrive in environments with a pH range of 8-8.5. However, the ecosystem of the Dong Thap Muoi region is characterized by acidic soils with low pH levels. Transitioning to high-pH water environments deprives native dragonfly species of their habitats. Surveys showed that no dragonflies were present in these shrimp farming areas, not even common high-flying species like *Pantala flavescens* or *Rhyothemis phyllis*.

To minimize the impacts on the environment and local ecosystems, the expansion of this model should be discouraged, and further studies on its impact on native species should be conducted.

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Appendix 1



Appendix 1. Some species of damselflies (Zygoptera) in Tram Chim (photographed by MKT).



Appendix 1. Some species of damselflies (Zygoptera) in Tram Chim (photographed by MKT) (continued).

Appendix 2



Appendix 2. Some dragonfly species (Anisoptera) in Tram Chim (photographed by PQT and MKT).



Appendix 2. Some dragonfly species (Anisoptera) in Tram Chim (photographed by MKT) (continued).



Brachydiplax chalybea - male



Brachydiplax chalybea - female



Neurothemis tullia - male



Neurothemis tullia - female

Appendix 2. Some dragonfly species (Anisoptera) in Tram Chim (photographed by MKT) (continued).



Tholymis tillarga - male



Tholymis tillarga - female



Diptacodes nebulosa - male



Diptacodes nebulosa - female

Appendix 2. Some dragonfly species (Anisoptera) in Tram Chim (photographed by MKT) (continued).

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