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# The Amphibian and Reptile Diversity of Tràm Chim National Park, Đống Tháp Province, Việt Nam

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*SIT Study Abroad*

# The Amphibian and Reptile Diversity of Tràm Chim National Park, Đống Tháp Province, Việt Nam

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## 1.0 Aknowledgements

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## 2.0 Abstract:

The herpetofauna of the Mekong Delta Region of Vietnam is not as frequently studied as the fauna of the Central and Northern Highlands Regions of the same country. Tram Chim National Park is situated in the Mekong Delta Region in Đồng Tháp Province and is one of the last remaining intact areas of the "Plain of Reeds" ecosystem that once used to cover this now mainly agricultural land. Although studies on the bird fauna, vegetation and ecological management of Tram Chim National Park are common, there has never been a study of the parks reptiles and amphibians. Moreover, by comparing the herpetological diversity between two differently managed areas within the park ($A_1$ and $A_2$) one can elucidate the effect of these conservation strategies on reptiles and amphibians. For 16 days the reptiles and amphibians of Tram Chim National Park were intensely documented by means of visual encounter surveys, pitfall traps and help from the local villagers. 440 reptiles and amphibians, composing 26 species were found. This represents 10 more species than found by Nguyen et al (2007) in an almost identical habitat in a neighboring province. The overall herpetological diversity of Tram Chim National Park was calculated, and it is extremely high (3.23 by Shannon's diversity index). It was found that, surprisingly, the improperly managed area of $A_2$ is actually more herpetologically diverse than $A_1$. However, this difference is most likely due to seasonal variations as many villagers said that substantially more reptiles are found $A_1$ during the wet season. In the end this study 1) documented the reptile and amphibian diversity of Tram Chim National Park, 2) concluded that the conservation management strategies of the park are sound and 3) may have also found up to 16 range extensions or confirmations.

## 3.0 Introduction:

The reptiles and amphibians of Vietnam have been well documented, but only in its most biodiverse areas (Bain et al 2008, Nguyen et al 2009). There is a high rate of endemic amphibian and reptile species in Vietnam, and as a result surveys to mountainous areas often yield new species (for example Bain and Nguyen 2004, Bain et al. 2008). Alternatively, because of the prospect of finding a new species in these forested mountainous areas, studies in less-forested areas like Southern Vietnam, in particular the Mekong Delta Region, are much rarer. Currently, the total number of amphibian and reptile species in Vietnam is more than 458, including 82 new species described since 1980 (Nguyen 2006).

Recently Nguyen et al (2009) published an unequivocal masterpiece of herpetological literature on the herpetofauna of Vietnam. It gives detailed descriptions of species' ranges, current names, former names (scientific, English and Vietnamese) and comes with a myriad of color plates to make identifications of morphospecies quite easy. Despite all this, its information in the Mekong Delta is lacking. This may be a product of a lack of studies done in the region or the fact that all of the authors are based in Hanoi. Thus information of the distributions of species in the Mekong Delta is of critical importance to herpetology in Vietnam.

On a more local scale, at Tram Chim National Park, this information is just as badly needed. There is a fair amount of literature on Tram Chim National Park, but it is mostly analyses of the management strategies of the park. Any studies relating to the fauna of Tram Chim National Park generally concentrate on birds and fish. Faunal inventories for amphibians and reptiles were rumored to exist, but were probably just the

results from Nguyen et al. (2007). Nguyen et al (2007) assesses the ornithological, ichtyological and herpetological biodiversity of an ecosystem that is extremely similar to Tram Chim National Park. The data that they have collected will be an excellent baseline of which this study will most likely follow closely. In order to properly asses the full biodiversity and to optimize its conservation efforts, a reptile and amphibian study must be completed in order to fill in the many gaps in herpetological knowledge at Tram Chim National Park.

Tram Chim National Park is located in near the town of Tràm Chim in Đồng Tháp Province in the Mekong Delta Region of Vietnam (Figure 1). Precisely it is located at 10°40' – 10°47'N, 105°26' – 105°36'E. The park is divided into five zones, $A_1$-$A_5$. $A_1$ is a well managed area whose hydrology is representative of the natural water flow in the grassland ecosystem. It is dominated by *Eleocharis sp.* grasses, but also has a few stands of *Melaleuca cajuputi* trees and wild rice (Nguyen and Wyatt 2006, personal observation). $A_2$ represents improper management. Water levels are kept unnacturally high here and as a result the grasses are much more densely packed, there is more *Melaleuca cajuputi* coverage and less *Eleocharis sp.* grows there (Nguyen and Wyatt 2006, personal observation). The other areas vary in their management strategies as well, but are unimportant to this study.

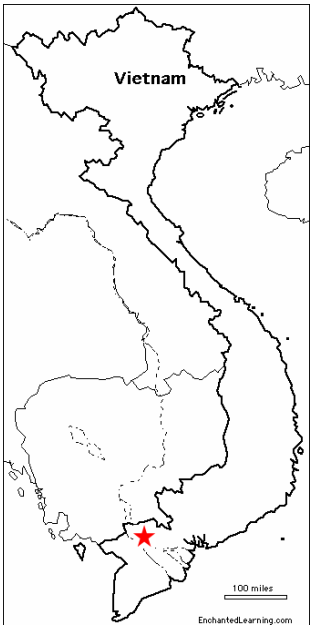


Figure 1: Location of Tram Chim National Park in the Socialist Republic of Vietnam (taken from EnchantedLearning.com).

The purpose of this study is to survey the reptiles and amphibians of Tram Chim National Park. Secondarily, this study aims to asses the differences in biodiversity

between the differently managed regions of $A_1$ and $A_2$ in the park to see what effect the management strategies have on their herpetofaunal diversities. These objectives will be completed by surveying and documenting the herpetofauna of these two areas systematically through pitfall traps, visual encounter surveys and with the aid of local villagers. Using carefully taken photographs of the animals, they will be identified using current primary literature, and will hopefully not be harmed in the process.

## 4.0 Materials and Methods:

Over the course of 16 days, from April 20th until May 8th (excluding May 2nd, 3rd and 4th), 2009, the author sampled for reptiles and amphibians in two areas of Tram Chim National Park referred to as $A_1$ and $A_2$ (Figure 3).

Three main techniques were used to document reptiles and amphibians within the park. First and most commonly, visual encounter surveys were conducted by the author (sometimes accompanied by members of the Tram Chim National Park technical staff). These were conducted on 14 of the 16 days at the park. These surveys involved walking along the dikes of $A_1$ or $A_2$, plains of grasses, *Melaleuca cajuputi* forests or roads adjacent to the park looking for any reptiles or amphibians. These surveys were conducted from 8:00 to 12:00 and/or from 19:00 to 22:00. We changed which section of the park we investigated each day and attempted to get some sort of visual survey from each major area (North, South, East and West) within $A_1$ or $A_2$.

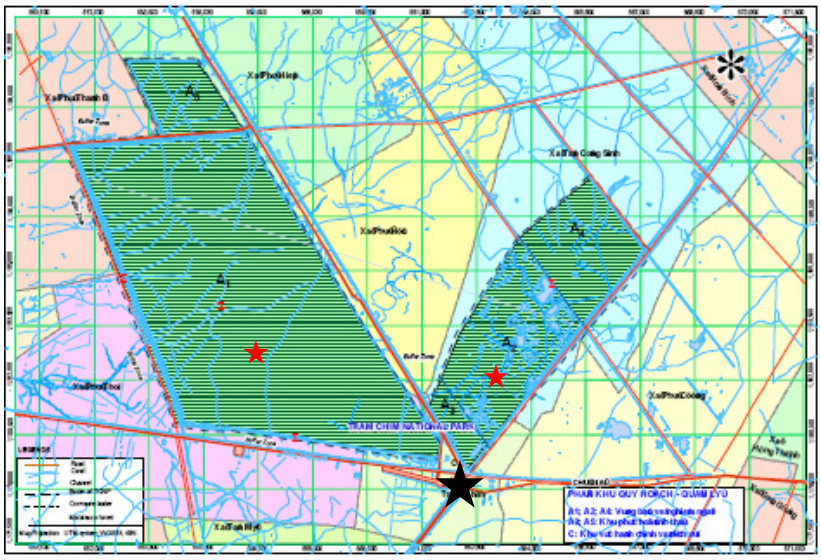

Figure 3: Administrative map of Tram Chim National Park (taken from Le 2005). The approximate locations of the pitfall traps in $A_1$ and $A_2$ (left and right respectively) are marked with red stars. The location of Tram Chim Town is marked with a black star.

The second technique used involved setting up pitfall traps in one location in $A_1$ and $A_2$. Pitfall trap design was based on Crosswhite et al (1999). Both traps used fishing net (hole size less than 2mm),

measuring 5m in length and 1m in height, that was dug into the ground approximately 5cm deep and stood upright by being tied to sticks of *Eucalyptus sp.* also dug into the ground. On each lateral side of the fishing net 4 buckets (from 8-12 liters in volume) were dug in the ground evenly spaced apart along the length of the fishing net. The buckets were always placed in the ground in such a manner that there was one (a 10 or 12 liter bucket) on both sides of the ends of the net, and so that the tops of the buckets were both flush with the ground and the side of the net. These traps were checked every other day in the morning when the visual encounter survey of the respective area of the park was being conducted. To ensure that the traps were in areas representative of the section of the park that they were in, the trap in $A_1$ was placed adjacent to an *Eleocharis dulchis* field and the trap in $A_2$ was placed adjacent to a *Melaleuca cajuputi* stand.

The final method for surveying for amphibian and reptiles used the help of local farmers to find the animals. These farmers were recruited by the technical staff and instructed to devote an entire day to capturing as many reptiles and amphibians as possible. The farmers were also instructed to remember the time and location of capture of each individual caught. In return for their service they were paid 100,000 VND. A member of the technical staff and the author would then meet the farmer the next day at the ranger station from where they based their searches. The specimens were documented then given back to the farmers to do with them what they wished. As each specimen was documented the farmer was asked where and when he caught them and the information was translated for the author by the member of the park's technical staff. Three farmers (each searching for a total of five days) were used in $A_1$, while five farmers (each

searching for a total of three days) were used in $A_2$. The discrepancy between these numbers resulted from poor planning and an unexpected holiday.

Whenever any reptile or amphibian was encountered it was photographed before attempting capture (unless it had already been captured by a farmer or pitfall trap). The time, locality, picture number, a tentative identification and any other pertinent notes were recorded in the work journal. If more than one individual of the same species was captured by the farmer, a representative individual was chosen to be photographed. The other individuals were simply counted, not photographed. A ventral scale on any snake captured and the first right finger of each amphibian was clipped for recapture information. After this process of documentation, the animals were released at their site of capture or returned to the farmers.

Upon returning to Cần Thơ data was entered into Microsoft Excel 2003 and analyzed. Choices of diversity indices came from Magurran (2004). Shannon's diversity index was calculated 1) because of tradition and 2) so it could be compared to the author's previous work in temperate habitats. Simpson's diversity and evenness measures were calculated because they fit the situation best and were recommended by Magurran (2004). Instead of 1/D being used for the Simpson's diversity measure, -ln(D) was used (Rosenzweig 1995, Magurran 2004). For overall measurements of evenness, all species were used, however in measures of evenness in $A_1$ and $A_2$ only those species encountered in the field were used. The species caught at the market and not encountered in the field are: *Cylindrophiidae ruffus, Python morulus bivittatus, Xenopeltis unicolor, Coelognathus flavolineatus, Pytas korros*, *Enhyris innominata, Enhydris subtaeniata, Homalopsis buccat* and *Malayemys subtrijuga*. *Hemidactylus frenatus* and *H. platyurus*

were also left out of the evenness and diversity indices because their abundance was heavily localized within the park headquarters.

## 5.0 Results:

Over the 16 day study period, 440 reptiles and amphibians were photographed or documented within two distinct areas in Tram Chim National Park. These animals represent 26 species spanning 14 families and 3 of 4 total orders of amphibians and reptiles. Table 1 (starting on page 20) gives a detailed species account, locality information and numbers caught for each specimen. Appendix 1 contains distinguishing photographs of most species. Only one specimen was ever recaptured. It was the *Enhydris subtaeniata* that was collected at the market but then released into $A_1$. The day after its release it was found dead floating in the water not more than 30 meters past where it had been released. Information on snake length, associated weather and microhabitat are available upon request.

Overall, Tram Chim National Park has a diverse assemblage of reptiles and amphibians according to Shannon's and Simpson's diversity indices. The evenness of the assemblage, however, is quite low, although it is higher than when the market species are included (Table 2).

| | A1 | A2 | Overall |
|---|---|---|---|
| **Simpson's Diversity Index:** | 1.05 | 1.2 | 1.11 |
| **Simpson's Evenness:** | 0.237 | 0.185 | 0.132 |
| **Shannon's Diversity Index:** | 1.3 | 1.64 | 3.32 |

Table 2: Simpson's diversity index and evenness measure, and Shannon's diversity index (Magurran 2004) for A1, A2 and overall in Tram Chim National Park

Between the areas of $A_1$ and $A_2$ diversity varied, although not as highly as expected given the large differences in species (18 species in $A_2$ and 12 species in $A_1$). Simpson's diversity and Shannon's diversity indices both follow the same trend and are slightly higher in $A_2$. Evenness is again quite low, but slightly higher in $A_1$. Thus overall,

$A_2$ is more diverse than $A_1$ in terms of reptiles and amphibians, but its species are less evenly distributed.

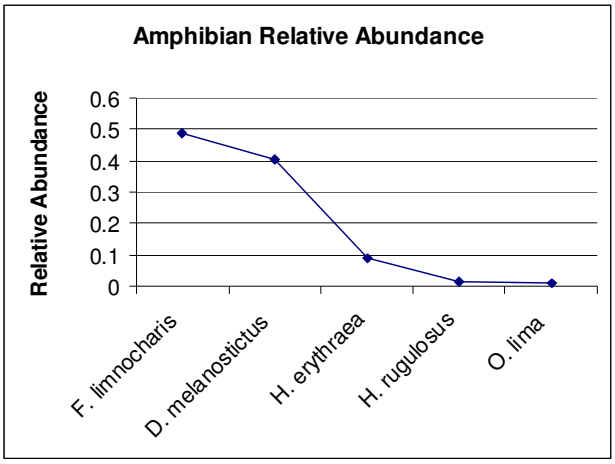


Figure 4: Relative abundance of amphibian species found in Tram Chim National Park. Relative abundance is calculated by the number of individuals of one species divided by the total number of individuals found. *F. limnocharis* = *Fejervarya limnocharis*, *D. melanostictus* = *Duttaphrynus melanostictus*, *H. erythraea* = *Hylarana erythraea*, *H. rugulosus* = *Hoplobatrachus rugulosus* and *O. lima* = *Occidozyga lima*.

Also, the reptile and amphibian communities are composed of different individuals in these two areas. It is apparent that, during the dry season, there are more snake species in $A_2$ than $A_1$ (13 and 3 respectively). $A_1$ does, however, have more lizard species (3 species in $A_1$, 2 in $A_2$), amphibian species (5 in $A_1$ and 4 in $A_2$), and a greater abundance of amphibians (236 in $A_1$ versus 158 in $A_2$). The most abundant animals were, by far, amphibians, accounting for 394 of 440 (89.5%) of all animals caught (see Table 1, page 20). Because of this discrepancy in abundances many reptile species were documented less than five times. Although more reptiles could be caught with a longer period of sampling, the ratio of amphibians to reptiles caught would likely remain similar thus leaving relative abundances of both reptiles and amphibians very different. Amphibian relative abundance is plotted in Figure 4, showing a large discrepancy between the abundance of *Duttaphrynus melanostictus* and *Fejervarya limnocharis* and all other amphibians. Reptiles are excluded because of their low overall abundance. It is obvious

that Tram Chim National Park is more abundant in amphibians, particularly *Duttaphrynus melanostictus* and *Fejervarya limnocharis.*

Pitfall traps were largely unsuccessful. The $A_1$ pitfall trap never yielded any reptiles or amphibians, and was stolen after only one round of checking, on April 25th. The pitfall trap in $A_2$ was more successful, although most of the information extracted from it could have been gathered in other ways. The three *Duttaphrynus melanostictus* that were found in it would most likely be encountered in other night walks throughout $A_2$.The pitfall trap in $A_2$, however, did capture one *Eutrophis multifasciata* which proved extremely useful in identifying previously seen skinks. These four animals were the only things caught in the pitfall traps in $A_2$. The approximate locations of the pitfall traps within $A_1$ and $A_2$ are in Figure 3.

The interviews provided a historical perspective on the current reptile and amphibian community. After talking with the director of the park, his brother and friend (all who have lived in Tram Chim for over 40 years), it became apparent that the communities are nothing compared to what they once were. Before the American War venomous species were "common," but now they are never seen. The reasons for this disappearance are not known, but assumed to be because of defoliants and hunting for meat and out of fear. The total snake species count before the war was over 35, but now is reduced by the locals to a probable 23. Turtles were also once very common and specious, but now only one species is left (and it is quite rare). After interviewing two merchants selling reptiles that were illegally caught in Tram Chim National Park, it became apparent that in the dry season fewer reptiles are found in $A_1$ and more in $A_2$. In the wet season, more reptiles are found in $A_1$ than $A_2$. In the wet season this can be as

much as 5kg per day from $A_2$ and 6kg per day from $A_1$. The reason for the difference between wet and dry seasons is unknown, but technical staff members believe it could be due to the difficulty of seeing snakes in the dry season when there are so many places to hide. The long-time residents of Tram Chim attribute this difference to the peaceful nature of $A_2$, as it is not explored by tourists and rarely poached in.

## 6.0 Discussion

### 6.1 Overall diversity and its implications for conservation

The diversity of reptiles and amphibians in $A_2$ is higher than in $A_1$. Although both the Shannon and Simpson diversity indices support this statement, there may be yearly fluctuations in the diversity of the areas. Interviews with both long-term residents of Tram Chim and snake poachers in Tram Chim indicate that there is indeed a shift in reptiles (especially snakes) found within $A_1$ and $A_2$ between the wet and dry season. Neither felt knowledgeable enough to comment on amphibians. A similar study done in the wet season would most likely confirm that the $A_1$ is indeed more diverse and has more overall reptiles in the wet season. Amphibian seasonal shifts are also likely and have been observed elsewhere in Vietnam (Ohler et al 2000). One of the reasons that *Duttaphrynus melanostictus* was encountered so frequently may be because of its tolerance to desiccation as a toad. However, it is unlikely that the amphibian community observed will shift dramatically between the wet and dry seasons. A study in a similar habitat conducted during the wet season only found one more frog species total, but this may be a misidentification (Nguyen et al 2006).

The reasons for the results of the diversity indices are complex and largely based on the index itself. First of all, the overall diversity of Tram Chim National Park is remarkably high. Although this is one of the least biodiverse regions in Vietnam (Bain et al 2008), the diversity measured by Shannon's diversity index is remarkably close to the usual upper limit of the index (3.5). It also far exceeds the score of 1.2 on the Shannon's diversity index that the author calculated for a reptile and amphibian community in the temperate region of Northern Ohio (Krohn 2008 unpublished). The diversity of the two

areas within the park is smaller when regarded separately. This owes to the fact that they have species that occur in one area of the park, but not another (for example most snakes, except *Enhydris enhydris* and *Xenochrophis flavipunctatus*, were only found in $A_2$), so that on their own these values are small, but when combined together over a larger area, the park itself can be considered diverse in reptiles and amphibians. $A_2$ seems to be more diverse based solely on the fact that more snakes were found there. Other than this one group, the two areas are almost identical in amphibian and reptile species composition. However, this evidence is not very strong. All species of snake found in $A_2$, except for *Ramphotyphlops braminus, Dendrelaphis sp., Enhydris enhydris, Erpeton tentaculatum* and *Xenochrophis flavipunctatus*, were only confirmed there by anecdotal evidence from a salesperson at the local market. Although she did confirm that they tend to find more snakes in the $A_2$ than in $A_1$ during the dry season, it is possible that she was mistaken, or that something was lost in translation, when she said that those other eight species were found in $A_2$. If indeed these snakes are found elsewhere as well, the diversity of $A_2$ will decrease and become about even with $A_1$. However, due to the presence of many more snake species, $A_2$ is more diverse in reptiles than $A_1$.

Amphibians and lizards show a quite different pattern. In species number, the two areas only differ by one species of each: *Occidozyga lima* and *Takydromus sexlineatus*, which are found in $A_1$, but not $A_2$. Also, the overall abundance of amphibians is higher in $A_1$. Thus, according to our study, amphibians are more numerous and specious in $A_1$, despite its lower herpetofaunal diversity. This is most likely a factor of the increased acidity of $A_2$ (Nguỹen Minh Hải, personal communication) compared with $A_2$. Lizards

were found to be more numerous in $A_1$, but this is most likely due to more searching hours spent in $A_1$ than in $A_2$.

The abundance of amphibians follows a predictable pattern. Although the large differences in abundances of amphibians may be due to seasonal variations in community structure, their Whittaker plot appears to be similar to a log normal species abundance model (Whittaker 1970, Magurran 2004) which indicates a low likelihood of a community with a strong species dominance. Thus, despite appearances, it is unlikely that the communities are actually dominated by *Duttaphrynus melanostictus* and *Fejervarya limnocharis*; they simply occur here in large numbers.

Evenness between the two regions is more complicated. It is obvious that Shannon's measure of evenness would not suffice for this study because of its high dependence on the underlying species richness (Magurran 2004). Simpson's measure of evenness ($E_{1/D}$) was used, but would be more helpful if it were compared to studies in Tram Chim from previous years to detect the changes in species composition. Regardless, it makes sense that evenness is so low here because of the differing abundance of amphibians and reptiles. This, however, could be due to sampling biases. It is obviously easier to catch terrestrial frogs and toads that are easily visible, but much harder to catch water snakes and tree snakes that move through the branches and water all day and only stop to sleep, bask and eat. This may explain the different relative abundances and the low overall evenness. Longer and more careful, systematic sampling may elucidate whether this situation is the cause of these values or whether these species are actually more rare. If they are indeed rarer, it is possible that this study may be underestimating species richness (May 1975, Magurran 2004).The difference in the evenness of species in

$A_1$ and $A_2$ is small, but visible. The difference itself is probably caused by the fact that $A_1$ has a higher abundance spread over fewer species, while $A_2$ has less abundance spread over more species. This information will be more useful when compared with future studies of the herpetofaunal diversity of Tram Chim National Park.

One way to put the diversity of Tram Chim National Park into perspective is to compare it to other areas in Vietnam. As stated previously, the Mekong Delta is the least biodiverse area of Vietnam (Bain et al 2008). It follows that any study of biodiversity here will pale in comparison to one in the central or northern highlands. Still despite this, Tram Chim National Park has a very diverse reptile and amphibian community that can be seen in as little as 16 days.

The most intelligent comparison that should be made is between the herpetofaunal diversity of Tram Chim National Park and Lang Sen Nature Reserve. Lang Sen is located in the neighboring province of Long An, and is composed of a similar "Plain of Reeds" habitat. The biodiversity report conducted there over 6 days (Nguyen et al 2006) will serve as an excellent baseline of comparison. As expected, the results from this study are very similar to those of Nguyen et al (2006). Both studies found an enormous amount of reptiles being sold in local markets, and found this to be an excellent source of information about local populations. This study found every snake, except for two (*Amphiesma stolatum* and *Cryptelytrops [Trimeresurus] albolabris*) that were found in Nguyen et al (2006). Interviews in Tram Chim with locals revealed that *C. albolabris* was indeed once found here before the war, but is now locally extinct. In addition to these snakes, this study found *Xenopeltis unicolor*, *Ramphotyphlops braminus*, *Pytas korros, Enhyris innominata* and *Homalopsis buccata* which were not found in Lang Sen. Nguyen

et al (2006) did however find the skink *Lygosoma quadripes,* the turtles *Amyda cartiginea* and *Cuora amboinensis*, and the frog *Occidozyga laevis* which were not found in Tram Chim. It seems like the skink community of Tram Chim is dominated by *Eutrophis multifasciata*, but this does not mean that *L. quadripes* is not present. The two turtle species may have once existed here, but now the only turtle species left is the locally rare *Malayemys subtrijuga*. According to Nguyen et al (2009), there are only 3 species of *Occidozyga* frogs in Vietnam. Two of these three were at one point referred to as *Occidozyga laevis*, but none were ever called the yellow puddle frog and neither of these two has been reported further south than Dong Nai province. More investigation into the identification of this frog is necessary to elucidate whether it was documented correctly. The additional nine species that were found in Tram Chim and not Lang Sen could also be attributed to the study length of this project being nearly three times a long.

The conservation implications of these diversity studies are obvious. First of all, it can now officially be noted that Tram Chim National Park does not only host a diverse assemblage of avian fauna, but it is also home to a diverse community of reptiles and amphibians. Also, despite the permanently high water levels of $A_2$, herpetofaunal diversity is higher there than in $A_1$. However, this should not be interpreted as evidence that the management style of $A_2$ is suitable. This diversity trend may very well reverse in the wet season as the water, birds and fish all flourish in $A_1$. Further studies are necessary to confirm this. Thus, the conservation strategies of $A_1$ are more favorable overall. $A_1$ may not boast the most diversity in the dry season, but overall the difference is not that great and it is without a doubt has more reptiles in the wet season. Moreover it is the only location where the IUCN Red List species *Python morulus* is found within Tram Chim

National Park. Most alarming is the dire need for reptilian conservation in Tram Chim National Park. Poaching of these (and many other) animals goes unchecked and there seems to be no punishment or enforcement of the National Park's rules. Historic declines of poisonous snakes, turtles and lizards have already been witnessed by long-time residents of the area and this trend seems destined to continue if hunting does not stop. Although Tram Chim National Park can boast its herpetofaunal diversity now, it may not be able to for very much longer.

## 6.2 Natural History Notes

A lot more than raw diversity index numbers was uncovered by this study. Natural history notes were taken whenever possible. In all cases this evidence corroborated with the behavior already published on the species. *Eutrophis multifasciata,* the only skink species encountered, was most active from 10AM until 3 PM. It tends to forage openly along the dikes and other dry, open areas and then take refuge in *Melaleuca cajuputi* roots or ground shrubs when disturbed. It also has numerous underground burrows in which it can see shelter. These may or may not have been dug by the lizard itself. *E. multifasciata* can be extremely color variant (Cox et al 1998, Grismer et al 2006) sometimes making identification difficult until closer inspection.

*Xenochropis flavipunctatus* was the only snake capture alive in the field. It was encountered attempting to seek shelter during the day in a partially submerged *Melaleuca cajuputi* tree. After capture, as has been noted elsewhere (Cox et al 1998), the snake struck voraciously, gaped and attempted to raise the front half of its body off the ground.

It would only strike, however, when something (either a hand or a stick) came within a close proximity to its head, and would not strike needlessly.

*Dendrolaphis sp* was the only other live snake encountered in the field and was found in between the wall and ceiling of a thatch ranger station during the day. This is evidence of *Dendrelaphis* snakes being adaptable to human habitations. Identification of this snake was impossible. It had the slender, elongate body and obvious round pupil, large eye and facemask of *Dendrelaphis*, but its body was green and black, not the usual coloration for *Dendrelaphis pictus*, which is the only species of *Dendrelaphis* found near Dong Thap province (Nguyen et al 2006, Nguyen et al 2009). It is imperative to have a better positive identification for this snake before asserting such a large range extension.

All the amphibians could be found along the dikes or roads bordering the park after a rain in the evening. *Hylarana erythraea* could be found along the ground or in the dikes at almost any time of day, but is especially common at night. Less common, but usually found in the same area is *Fejervarya limnocharis*. *Duttaphrynus melanostictus* could be found regardless of rain, while most others would not be found without rain. *Occidozyga lima* was most commonly found during the day sitting with nostrils and eyes exposed at the surface of the water in submerged *Eleocharis sp.* fields.

Based on the number and frequency of amphibians caught by farmers in $A_1$, it is likely that *F. limnocharis* is more common in northwestern $A_1$, while *D. melanostictus* is the most common amphibian in southern $A_1$ during this time of year. This however, is not based on the most solid of evidence, as the information comes solely from the number and kinds of amphibians that farmers caught in one specific area of the park.

Although *E. multifasciata*, *Takydromus sexlineatus*, *Dendrelaphis sp.*, *Calotes versicolor*, *Occidozyga lima*, *Duttaphrynus melanostictus* and *Fejervarya limnocharis* were found during the day, the vast majority (including the amphibians above) of reptiles and amphibians were found, or reported to be found, at night. One of the most common places to find reptiles and amphibians during the day was actually near the nets of a sympatric experiment in wet *Eleocharis sp.* fields. *Xenochrophis flavipunctatus*, *Occidozyga lima* and *Hylarana erythraea* were all found here (*H. erytheraea* on more than one occasion). All were attempting to seek refuge in or around the netted off area.

Finally, if the distributions in Nguyen et al (2009) represent the most up-to-date reptile and amphibian distributions in Vietnam, then this study has discovered numerous changes. There are number of species that have been found in other provinces in the Mekong Delta, but not specifically in Dong Thap. For these species, this represents the completion of a hole in the range where the species would be expected to occur, but where it has not been formally proven to exist. The species for which this is applicable are: *Hemidactylus platyurus, Eutrophis multifasciata, Ramphotyphlops braminus, Cylindrophiidae ruffus, Python morulus bivittatus, Xenopeltis unicolor, Pytas korros, Enhydris bocourti, Enhydris enhydris, Enhydris innominata, Enhydris subtaaeniata, Erpeton tentaculum, Homalopsis buccata, Malayemys subtrijuga* and *Occidozyga lima*. This study has found two species for which their confirmed presence in Dong Thap Province represents a significant range extension. *Takydromus sexlineatus* has never been found south of Dong Nai Province and *Coelognathus flavolineatus* has never been found south of Binh Phuoc Province. This study has succeeded in expanding the current knowledge of herpetology in Vietnam

## 6.3 Problems and Advice for Future Research

One never expects to devote an entire section to the problems of their research, but in this study it was inevitable.

The first major obstacles were expected and reasonably normal. They included translational and cultural differences. Pitfall traps were hard to install correctly, messages were delayed and misinterpreted and things never went as expected. Farmers were instructed to carry out the survey for an entire day, but often times only reported catching amphibians around 22:00. This could be due to a translation gap between myself and the farmer, because the farmer simply was working during the day or because amphibians actually were not found until that time, although I doubt the truth of this final statement. A good example of cultural differences effecting herpetological research is the fact that it was not until after having shared rice wine and dinner (forming a relationship) did the director of the park take an interest in my project. After this he arranged interviews, found farmers to catch animals and did anything in his power to help me. Unfortunately, this all occurred within my last two days in the park. Future researchers, and in my research in the future I, must immediately try to form friendly relationships with as many of the staff members as possible and be as open as possible about the project so that they will feel comfortable to share any knowledge that they may have to help.

Other problems were more unavoidable, but worth noting so that these mistakes are not made again. One example involved someone stealing the nets to my pitfall trap in $A_1$. Nets are a high value commodity here in Tram Chim because most of the villagers are subsistence fishermen or farmers. Future studies must 1) not use nets, 2) not put the

pitfall traps in highly poached areas such as $A_1$ or 3) put the nets in more obscure, less visited spots than on a dike.

There are some inherent problems with Tram Chim National Park that make it difficult to do this kind of field work, and may skew the results. First and foremost, the park is basically only accessible by boat, especially in the wet season. Since one rarely encounters reptiles and amphibians by motorboat, the ones that will be seen most frequently will have some sort of association with the dikes. Frequent transects through the fields and *Melaleuca cajuputi* stands must be taken to avoid this. These and more normal pitfalls of this sort of research are discussed in Magurran (2004). After completing 16 days of field work and learning most of this the hard way, the best advice that I can give is to spend as much time as possible exploring in the field, even if you have not seen anything of interest for the past three days.

Regardless of whether the project is social or natural science based, the strongest advice that I have for future researchers is to seek the advice of the local people. They have lived here all of their lives and know the land much better than you and can be endless sources of information if you only take the time to become friends with them and listen. Had I done this from the start my results would probably look much different. Also, do not expect to have things the way that you planned before you arrived. Give yourself a few days at the start to survey the land, talk to the local people and pick the best spots for your experiment, trap or whatever. Plan first, and extensively, and then execute a well planned project with efficiency and the support of the people around you. This will make any job in the field infinitely easier. Last but not least, remember, "Plan as if everything will run smoothly, but expect that everything will go completely wrong."

## 6.4 Conclusion

In conclusion, the diversity of Tram Chim National Park is overall very high. This is to be expected for a region in the tropics, but it was not expected to be so high due to the fact that the Mekong Delta is so developed and is the least biodiverse place in Vietnam. During the dry season, the herpetofaunal diversity in $A_2$ is greater than that of $A_1$. This is counterintuitive as $A_1$ represents a more natural hydrology and ecosystem. However, this diversity is thought to not be sustained in the wet season, when more reptiles are found in $A_1$ rather than $A_2$. Thus, management strategies for Tram Chim National Park are proceeding in the correct way by focusing on making more of the park hydrologically similar to $A_1$. However, it is important to note that having an area like $A_2$ is not always a negative thing as it acts as a reservoir for reptiles when the waters recede out of $A_1$ during the dry season. All in all, Tram Chim National Park has a diverse assemblage of reptiles and amphibians, but if poaching and hunting continue to go unchecked, it may not be this way for very much longer.

Table 1: A list of all species found in Tram Chim National Park, with both English and Vietnamese common names given, as well as the general locality within the park. HQ = Headquarters area adjacent to $A_1$. All names and organization are based off of Nguyen et al. (2009). See Appendix 1 for photographs.

| | | | | |
|---|---|---|---|---|
| **Class Reptilia** | | | | |
| **Order Squamata** | | | | |
| Sauria | | | | |
| Family Agamidae | | | | |
| Scientific name | English Name | Vietnamese Name | Number caught | Location |
| Calotes versicolor | Garden fence lizard | Nhông xanh | 3 | HQ, A2 |
| Family Gekonidae | | | | |
| Scientific name | English Name | Vietnamese Name | Number caught | Location |
| Hemidactylus frenatus | Spiny-tailed house gecko | Thạch sùng đuôi sần | 2 | HQ |
| Hemidactylus platyurus | Flat-tailed house gecko | Tắc kè đuôi dẹp | 1 | HQ |
| Family Lacertidae | | | | |
| Scientific name | English Name | Vietnamese Name | Number caught | Location |
| *Takydromus sexlineatus* | Six-striped long-tailed grass lizard | Liu điu chỉ | 1 | HQ |
| Family Scincidae | | | | |
| Scientific name | English Name | Vietnamese Name | Number caught | Location |
| *Eutrophis multifasciata* | Many-lined sun skink | Thằn lằ bóng hoa | 15 | A1, A2 |
| Serpentes | | | | |
| Family Typhlopidae | | | | |
| Scientific name | English Name | Vietnamese Name | Number caught | Location |
| *Ramphotyphlops braminus* | Flowerpot snake | Rắn giun thường | 2 | A2 |
| Family Cylindrophiidae | | | | |
| Scientific name | English Name | Vietnamese Name | Number caught | Location |
| *Cylindrophiidae ruffus* | Red-tailed pipe snake | Rắn trun | 1 | A2 |
| Family Pythonidae | | | | |
| Scientific name | English Name | Vietnamese Name | Number caught | Location |
| *Python morulus bivittatus* | Burmese python | Trăn đất | 1 | A1 |
| Family Xenopeltidae | | | | |
| Scientific name | English Name | Vietnamese Name | Number caught | Location |
| *Xenopeltis unicolor* | Sunbeam snake | Rắn mống | 1 | A2 |

Family Colubridae
Subfamily Colubrinae

| Scientific name | English Name | Vietnamese Name | Number caught | Location |
|---|---|---|---|---|
| *Coelognathus flavolineatus* | Black copper rat snake | Rằn sọc vang | 1 | A2 |
| *Dendrelaphis sp.* | | | 1 | A2 |
| *Pytas korros* | Indochinese rat snake | Rắn ráo thường | 1 | A2 |

Subfamily Homalopsinae

| Scientific name | English Name | Vietnamese Name | Number caught | Location |
|---|---|---|---|---|
| *Enhydris bocourti* | Bocourt's water snake | Rắn ri voi | 2 | A1, A2 |
| *Enhydris enhydris* | Rainbow water snake | Rắn bông súng | 6 | A1, A2 |
| *Enhyris innominata* | Mekong delta water snake | Rắn bông không tên | 1 | A2 |
| *Enhydris subtaeniata* | Mekong mud snake | Rắn bu lịch | 1 | A2 |
| *Erpeton tentaculatum* | Tentatculed snake | Rắn râu | 3 | A2 |
| *Homalopsis buccata* | Puff-faced water snake | Rắn ri cá | 1 | A2 |

Subfamily Natricinae

| Scientific name | English Name | Vietnamese Name | Number caught | Location |
|---|---|---|---|---|
| *Xenochrophis flavipunctatus* | Yellow-spotted keelback | Rắn nước | 3 | A1, A2 |

**Order Testudines**
Family Geoemydidae

| Scientific name | English Name | Vietnamese Name | Number caught | Location |
|---|---|---|---|---|
| *Malayemys subtrijuga* | Mekong snail-eating turtle | Rùa ba go | 1 | Unknown |

**Class Amphbia**
**Order Anura**
Family Bufonidae

| Scientific name | English Name | Vietnamese Name | Number caught | Location |
|---|---|---|---|---|
| *Duttaphrynus melanostictus* | Asian common toad | Cóc nhà | 158 | A1, HQ, A2 |

Family Dicroglossidae

| Scientific name | English Name | Vietnamese Name | Number caught | Location |
|---|---|---|---|---|
| *Fejervarya limnocharis* | Paddy frog | Ngóe | 192 | A1, HQ, A2 |
| *Hoplobatrachus rugulosus* | Chinese bullfrog | Ếch đồng | 5 | A1, A2 |

Subfamily Occidozyginae

| Scientific name | English Name | Vietnamese Name | Number caught | Location |
|---|---|---|---|---|
| *Occidozyga lima* | Green puddle frog | Cóc nước sần | 4 | A1 |

| Family Ranidae | | | | |
|---|---|---|---|---|
| Scientific name | English Name | Vietnamese Name | Number caught | Location |
| *Hylarana erythraea* | Green paddy frog | Chàng xanh | 35 | A1, A2 |

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