



Société d'Ornithologie de Polynésie

Meet the Last Population of Marquesan Kingfisher in French Polynesia

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Conservation Leadership Programme: Project Reporting

The main aim of this project is to update the situation of *Todiramphus godeffroyi*, an endangered species of French Polynesia.

Tahuata Island, Marquesas Archipelago: 4th of December- 24th of December 2011

Table of Contents

Section 1: The last population of Marquesan Kingfisher on Tahuata Island

Summary.....	p.1
Introduction.....	p.2
Project members.....	p.5

Section 2: The Marquesan Kingfisher current situation

Aims and objectives.....	p.6
Methodology.....	p.7
1. Population survey.....	p.7
a) Occupancy model to estimate the species population.....	p.7
b) Determination of the population trend.....	p.8
2. Research of the nest of Marquesan Kingfisher.....	p.8
3. Observation of birds and their behavior.....	p.8
4. Characterizing the habitat of Marquesan Kingfisher.....	p.8
5. Predators determination.....	p.9
a) Rats and Feral Cats.....	p.9
b) Great Horned Owl.....	p.9
6. Involving the local community.....	p.9
Outputs and Results.....	p.10
1. Population survey.....	p.10
a) Occupancy model to estimate the species population.....	p.10
b) Determination of the population trend	p.10
2. Research of the nest of Marquesan Kingfisher.....	p.11
3. Observation of birds and their behavior.....	p.11
4. Characterizing the habitat of Marquesan Kingfisher.....	p.11
5. Predators determination.....	p.12

a) Rats and Feral Cats.....	p.12
b) Great Horned Owl.....	p.13
6. Involving the local community.....	p.14
Achievements and Impacts.....	p.18
<u>Section 3: Future recommendations for Marquesan Kingfisher conservation</u>	
Conclusion.....	p.19
Problems encountered and lessons learnt.....	p.20
In the future.....	p.21
<u>Section 4: Field raw data and PowerPoint presentations for the local community</u>	
Appendices.....	p.22
Bibliography.....	p.37
Address and useful websites.....	p.40

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Section 1: The last population of Marquesan Kingfisher on Tahuata Island

Summary

The Marquesan Kingfisher, *Todiramphus godeffroyi*, is an endemic species of the Marquesas archipelago in French Polynesia. Its population is only found on Tahuata Island, having disappeared recently from Hiva Oa. The aim of this conservation project is to evaluate its current population and identify threats that affect its future.

The methods used was firstly a point-count survey to evaluate the current population, with points separated by 300 meters and a given time of 10 minutes. These point-counts were revisited three times based on occupancy modeling. The software program, Presence, was utilized for the statistical analysis.

To evaluate the population trend, the 2003 point-counts were revisited for a given time of one hour. The population is currently estimated as ~451 [401-484] individuals. It has been established that its trend is declining, with 39 % absent territories since 2003.

Observation of M. Kingfisher's behavior, nests and habitat requirements improved the knowledge about the species. The presence of feral cats, another important threat, was reported. Night surveys and playing the sound recording of the Great Horned Owl indicated its absence. Two PowerPoint presentations were prepared for the local community and the school children of Vaitahu. Establishing contact with well-respected locals such as the mayor and the local guide facilitated communication with the inhabitants. This is clearly important for the success of future conservation projects. A recommendation for follow-up projects, if this method of detection is utilized, is to increase the number of visits of the point-counts. A different method of detection, which is more adapted to the M. Kingfisher, should be envisaged for future projects.

Introduction

There are four species of Kingfishers in French Polynesia. Two of these, the Tuamotu and Marquesan Kingfisher, are classified as endangered species (IUCN 2011, Birdlife 2011).

The Marquesan Kingfisher (*Todiramphus godeffroyi*) is classified, according to the International Union for the Conservation of Nature Red list, as a critically endangered species (CR) (IUCN 2011, Birdlife 2011). The French Polynesian government environmental program has placed this species in the A category, that is, of a protected species.

The long-term objective is to protect this species from complete extinction as *T godeffroyi* is endemic to the Marquesas Islands. It is extinct on Hiva Oa (the main island) and only found on Tahuata Island. The data that was last collected on the M. Kingfisher was in 2003 (Gouni, 2004). It is therefore essential to follow up on the current situation on Tahuata Island.

Marquesas Islands:

The Marquesas archipelago consists of twelve volcanic islands, which lies 1,400 Km north-east of Tahiti. The Marquesas are divided into two groups. In the North, Nuku-Hiva, Ua-Uka and Ua Pou. In the South, Hiva-Oa, Tahuata and Fatu Hiva. The other six islands are uninhabited. The whole population is around 9000 inhabitants (Deschamps & Deschamps, nd.).

The first inhabitants were originally from Western Polynesia and settled around 150 BC to 100 AD. These islands were unknown to the world until Alvaro de Mendana discovered it accidentally in 1595. On his voyage to colonize the Solomon Islands, financed by the Marquis Hurtado de Mendoza, Mendana made a navigational error, which led him to the unknown islands. He named them after the wife of the Marquis, “Marquesas de Mendoza”, honoring the man who financed his travel. He first landed at Hiva Oa and Tahuata, and claimed the islands for the king of Spain.

Tahuata Island is a small island separated from Hiva Oa by the Bordelais Channel, which is only four km wide. It was the first island discovered by Mendana. The surface area of Tahuata is around 50 km² and the tallest summit is 1000 m high. The population comprises around 640 inhabitants, who earn their money from coprah, handcrafts and tourism (Deschamps & Deschamps, nd).



Figure 1: Hiva Oa (picture taken from Tahuata) and Vaitahu bay in Tahuata (Withers, 2011)

The population of Tahuata is essentially the key partner of this project. The mayor of Tahuata Island was extremely helpful, providing everything that we needed. The local guide actively participated in all the activities that were planned for this project

Marquesan Kingfisher:

Marquesan Kingfisher, *Todiramphus godeffroyi*, is named ‘Pahi’ by the locals and is endemic to the Marquesas Islands (Thibault & Guyot, 1988). It is part of the Alcedinidae family and was first described by Finsch in 1877 (*Halcyon godeffroyi*). Its genus is often merged into *Halcyon*. It forms a superspecies with *T. sanctus*, *T. australasia*, *T. tutus*, *T. veneratus* and *T. gambieri*. It is monotypic (del Hoyo et al., 2001).

Its habitat consists of primary forest, and it prefers dense humid forest along mountain streams in remote valleys. It was also observed in coconut plantations, on dry slopes with mango and *Eugenia cuminii* trees, as well as on peaks covered with *Casuarina equisetifolia* groves. Its habitat ranges from lowlands to mid-latitudes. Its food consists of insects, mainly beetles (*Coleoptera*), large grasshoppers (*Orthoptera*), and small lizards (del Hoyo, 2001).



Figure 1: Tahuata Island map (retrieved from the “Services de l’Aménagement et de l’urbanisme”, Papeete, Tahiti, 2011)

Project members

Thierry Autai is the team leader and the logistic officer at the SOP Manu organization.

Thomas Ghestemme is the programme manager at SOP Manu organization. He collaborated for the methodology, during the first week of the trip and trained the team.

Adara (Tehani) Withers is originally from Tahiti and is a second year student of Waikato University (Hamilton, New Zealand). She is currently studying for a Bachelor of Science and Technology degree, specializing in Restoration Ecology.

Thierry Autai and Tehani Withers stayed during the whole trip on Tahuata Island.

Section 2: The Marquesan Kingfisher current situation

Aim and objectives

The main aim of this project is to update the situation on *T godeffroyi*, an endangered species of French Polynesia. There are several objectives for this project.

Firstly, it is important to improve our knowledge about *T godeffroyi*. There have not been many studies on this particular species. The last scientific expedition on M. Kingfisher was in 2003 and a report was published in 2004 (Gouni, 2004). The population is declining according to the IUCN red list and Birdlife (IUCN 2011, Birdlife 2011), and this short research program will allow us to verify this trend.

The second objective of this project was to make an estimation of the different threats on *T godeffroyi*. The general threats towards the birds in French Polynesia are: rats, feral cats, invasive introduced birds species and human impact on the environment.

In the study by Gouni (2004) the only major threat for M. Kingfisher was the loss of their habitat due to human impact. The fact that they had difficulties finding a good nesting area seemed to determine the number of this population species. This leads to the third objective, which is to involve the local community. Explaining and informing the locals about the importance of the bird habitat, nesting periods, and behavior is crucial to the species future. The local population would then be encouraged to be actively involved in the protection of this bird species.

Methodology

1. Population survey
 - a) Occupancy model to estimate the species population

The goal of the occupancy model is to determine the probability that a site is occupied, given that organisms are imperfectly detected (Donovan & Hines, 2007).

The software that is used for this model is Presence (Hines, 2006). Presence was developed to enable the estimation of the probability that a site is occupied.

The input that this model requires is a series of detection histories for each site. In our case, the site will be the equivalent to point-count survey. Each detection history includes $k=3$ visit occasions and comprises of a series of 1's and 0's. Moreover, each 1 represents a detection of the species on the point-count, during a given time of 10 minutes. Each point is separated by 300 m. Any visual or auditory signal that is emitted by the species is defined as detection.

With the Presence software, the False-Positive Detection model was run since the data includes certain and uncertain data (see appendix 1). As some areas were only accessible by boat, the data was adapted into three surveys rather than one. In addition, some outside point-counts data (see map 2) were also reported and used to reduce the confidence interval. This data is counted as uncertain data. Nine hectares were chosen because with a point detection method, the number of individuals at the point (over the same time period) is the number of individuals whose home ranges overlap at that point. It means that the effective area to which those individuals belong will be greater than the nominal size of the point-count station (Mackenzie, 2011).

The surface of the island was calculated with Arc-Gis. The four villages and the areas with unfavorable areas were not included in the calculation.

Table 1: Surface of Tahuata Island

Total surface of Tahuata	6858 ha
Unfavourable areas	1510 ha
Principal maintained Coconut plantation	299 ha
Principal Aito patches	170 ha
Previous forest fire	113 ha
Surface for population estimation	4766 ha

b) Determination of the population trend

The “Service de l’Aménagement et de l’urbanisme” (Planning and Urban development) of Papeete (Tahiti’s capital) provided a map and a satellite picture of Tahuata Island. Arc-Gis (ArcMap) was used to draw the transects and the point-count that Gouni (2004) studied in 2003.

Arc-Map is the Arc-GIS central application, used for all-maps based tasks including cartography, map analysis and editing (Esri, 2012). Arc-Map is used here to map the species individuals, the point-counts, and also the evolution of the population trend since 2003.

The individuals that were previously spotted in 2003 were reported on the map. These areas were revisited during the fieldtrip, during a given time of one hour by two to four observers. This permits to determine the changes that have taken place from the 2003 study and verify the population trend.

2. Research of the nests of Marquesan Kingfisher

Like other kingfishers, the nest is usually constructed in a tree trunk. It is composed of a corridor, which opens to a cavity where the eggs are laid (del Hoyo, 2001). At each nest that was found, the species of the tree was identified. This allowed us to identify the types of trees that *T godeffroyi* uses for its nest. The nests were then marked on the map.

3. Observation of birds and their behavior

While detecting the individuals of *T godeffroyi*, their behavior was also observed. For example, if there were a couple, constructing nests, or defending their territories. This was to improve our knowledge on this particular species.

4. Characterizing the habitat of Marquesan Kingfisher

With the satellite maps, four kinds of areas were determined (see map 4). The first were the areas where the M. Kingfisher would not likely settle, as the conditions were not adapted. Essentially their territory had to have trees. However patches with only maintained Coconut plantations or Aito trees were not likely to be chosen as suitable habitat. Coconut plantations are not suitable because of the coprah production, an activity that consists of picking coconuts and drying them. Locals usually maintain the plantation by cutting the dead coconut trees. In the case of the Aito trees, the wood is extremely hard and therefore cannot be used for nests. Finally, the areas recently affected by previous forests fire were reported as well. Avoiding the areas where the M. Kingfisher would not likely settle would permit to precise the surface of favorable habitats.

5. Predators determination

a) Rats and Feral Cats:

The technique used to survey the rat population of the island was rat trapping. A line of 40 traps was laid for 3 nights. Rats trapped were identified, weighted, and the tail, body and ears measured. This was carried out to determine the presence of rats on the island.

Their percentage of capture was also calculated and compared with the data from Fatu Hiva (Le Barh, 2011):

Total number of nights-traps = Number of traps X Number of checks per day (1)

Number of lost nights-traps = $\frac{1}{2}$ (Number of captures + Number of traps triggered) (2)

Number of corrected nights-traps = (1) - (2) = (3)

Abundance (%) = (Number of captures x 100)/(3)

For feral cats, a cat faeces survey on the side of the roads was conducted. The cats that were spotted during surveys or any other activities were also reported. It determined the presence of wild cats on the island.

b) Great Horned Owl:

At night, listening for birds was the technique used to research Great Horned Owl (*Bubo virginianus*). A sound record of the Great Horned Owl was also played during the night. The owl voice might generate an answer from the Great Horned Owls.

6. Involving the local community

Two PowerPoint presentations about the M. Kingfisher were prepared for the local community (see appendix 4 and 5). One presentation was for the local school of Vaitahu, which is the only school that had children of the age of 6 to 10 years old. The other schools were all kindergartens (3 to 6 years old). The other presentation was presented to the population at the town hall under the auspice of the mayor of the island.

Outputs and Results

1. Population survey

a) Occupancy model to estimate the species population (see figure 2 and map 1)



Figure 2: The team at different point-count stations (Ghestemme & Autai, 2011)

The individual site estimate (psi: occupancy probability) is 0.8519, with a standard error of 0.0395 and a 95% confidence interval of [0.7570-0.9140].

Calculation: $0.8519/9 \text{ ha} \times 4766 \text{ ha} = 451.13 [400.87-484.01]$

The estimated population of M. Kingfisher is of ~ 451 individuals on the suitable area of the island, with a confidence interval of [401-484].

b) Determination of the population trend



Figure 3: The team at different point-counts of 2003 (Autai & Ghestemme, 2011)

Most of the points-counts made in the 2003 study were revisited during a given time of one hour (see figure 3). It confirmed Gouni's (2004) finding that the species kept to the same territories for years (see map 3). There were twenty-five point-counts where individuals were detected for the 2003 study. Seven of these were not visited on this trip for accessibility and time reasons. The visited ones (18) showed 11 point-counts where individuals were present and 7 where they were absent (39%). It seems that the population trend has been declining. However it has been 8 years and the habitat or territories might have changed since then.

2. Research of the nest of Marquesan Kingfisher

Less nests than the 2003 study (Gouni, 2004) were reported during this trip (see figure 4, map 2 and appendix 3). Often, it was difficult to determine if there were only nests attempts or old nests. Our data showed that the *Pandanus tectorius* (Fara) was the species of tree that they mainly choose to settle in. However in the previous study, the percentage of settlement was only 24%. Only one *Cocos nucifera* had a nest, although Gouni (2004) has identified it as a popular tree (33%) for the settlement of the M. Kingfisher. It may be because dead coconut trees are cut or burnt and replaced with new trees. It also confirmed that the same trees could be used for several years. Harder trees, like the *Artocarpus altilis* (Uru) or *Fixus prolixa* (Ora'a), had to be in an advanced state of deterioration before they could settle in.



Figure 4: *T godeffroyi* nests in different tree species (in order above): “Ehi” (coconut tree; *Cocos nucifera*), “Fara” (*Pandanus tectorius*), “Ora’a” (*Fixus prolixa*) (Withers, 2011)

3. Observation of birds and their behaviour

The birds that were spotted were either by themselves or in couple. Only one couple was observed with their juvenile, which might have recently left the nest since it was still colored black and blue (juvenile colors). When they are observed in a couple, it could be that they were looking for a tree to nest in, and had not yet reproduced (personal observation).

In the case of single individuals, their situation depended whether or not they had a defensive behavior against the observer. When an individual saw the observer, its frequent reaction was to fly away and signaling the danger with an alarm call. Another reaction was to attack, flying towards the observer and signaling the danger with an alarm call (personal observation). It could then be assumed that there was a couple in the area, with a breeding activity.

4. Characterizing the habitat of Marquesan Kingfisher

Table 2: Habitat of the Marquesan Kingfisher

Habitat	Point-count number with	Without <i>T godeffroyi</i>
Forest (dense)	9	27
Forest (open)	1	14
Forest (semi-open)	2	4
Banana plantation	2	3
Noni Plantation	3	5

At each point-count, the habitat was reported. Tahuata Island is mostly covered by forest, and there were open or semi-open areas, mostly in high or inhabited places. Next to the road, there were a few banana and noni (*Morinda citrifolia*) plantations, sometimes mixed. These did not seem to be a problem for the Marquesan Kingfishers that used them as a territory, even if some of the forest were cut.

5. Predators determination

a) Rats and Feral Cats:

Unlike in 2003 where no rats were found, our study showed the presence of rats (see figure 5).



Figure 5: Setting the traps (Withers, 2011) and study of the captured rats (Ghestemme & Autai, 2011)

Only one Black Rat *Rattus Rattus* was captured (see appendix 2). A few coconuts seemed to have been nibbled by this species (personal observation). It was mostly the Polynesian Rat *Rattus Exulans* that were captured by the trap line.

Table 3: Abundance of Rats on Tahuata Island

Number of traps	40
Number of captures	13
Number of <i>Rattus rattus</i>	1
Number of <i>Rattus exulans</i>	12
Triggered traps (without capture)	1

$$(1) 40 \times 1; (2) \frac{1}{2} (13 + 1) = 7; (1) - (2) = (3) = 40 - 13.5 = 33$$

$$\text{Abundance capture} = (13 \times 100) / 33 = 39.39 \%$$

The traps were checked once a day. The percentage of capture calculated is 39.39 %, which is quite close to the data found in Fatu iva, with the highest percentage being 52 %.

Feral cats were observed at different places of the islands, even on the highest mountains.

b) Great Horned Owl:

Observations for the presence of the Great Horned owl were carried out over two nights, with four hours on the first (6 to 9 pm) and 8 hours on the second (6 to 9 pm, and 2 to 5 am). No owl was seen or heard (see figure 6). We only heard the calls of a few Tahiti Petrel “Noha” (*Pseudobulweria rostrata*) and one White-capped Fruit-dove “Kuku” (*Ptilinopus dupetithoursii*).



Figure 6: Playing the recorded sound of the Great Horned Owl (Autai, 2011)

6. Involving the local community:

The mayor organized the meetings with the population (appendix 4), and with his help we were able to convey the importance of protecting this species.

We informed them about the species, discussing how human activities could endanger the bird. This included telling them about dangers of leaving cats in the wild, cutting or burning dead trees, which would leave the species with no place to construct their nests. We also discussed how they could help protect the M. Kingfisher by simple methods like conserving the dead trees. The inhabitants were very interested and each time they saw a M. Kingfisher, they would come to tell us about it.

We also asked them if they had seen any Great Horned Owl and if they did, their location. According to the local guide, an owl was brought on the island, but died soon after (around the 70s). Another local, while sleeping in a coconut plantation, informed us that he might have seen one, and that is where we went for our second night’s observation. Further, we discussed with

goat hunters that hunted on Hiva Oa, where the Great Horned Owl is present. They had never heard its call in Tahuata. On the second night's observation we met another local who usually goes to work at 4 am every morning. We made him listen to the sound recording and he informed us that he had never heard it before. At the public meeting, where 20 people were present, claimed to not have heard or seen it before.

Since the mayor is also the director of the school of Vaitahu, he organized the presentation for the children (appendix 5 and figure 7). We did not only talk about the M. Kingfisher, but also about other birds of the island to make them interested in conserving birds in general. We quizzed them about what was a bird, what were the differences between marine and terrestrial birds, if they were endemic, native or not. We discussed with them about the ways they could protect the kingfisher and asked them to talk to their parents about the importance of protecting this species. We provided books about birds and environment in general, as a gift for the schools of the island.



Figure 7: Presentation at Vaitahu primary school (Ghestemme, 2011)

The mayor was really helpful with organizing everything before we arrived, providing us with an accommodation and a car (see figure 8). The local guide Tohe participated actively in all the project activities, during 90 % of the fieldtrip. He was also really helpful when we were asking questions about the M. Kingfisher or the Great Horned owl to the population. He spoke in marquesan and because he is well-known, he knew who to approach. He could locate the M.

Kingfisher easily because of his experience, and this was particularly useful for us since none of us had seen this species before this trip.



Figure 8: Car and house that were provided by the mayor (Autai & Withers, 2011)



Figure 9: Pictures of the locals that we met on this trip. Picture 1: Two team members with Tohetia the local guide; 2: The mayor's wife and Tohe accompanying the team on the point-count survey; 3: Saying goodbye to the mayor's family and Tohe (Autai & Withers, 2011).

Achievements and Impacts

The achievements of this project are the evaluation of *T godeffroyi* population, contributing to know its trend and to update of information on this species. The results show that the population seems to be declining since 2003. The method of detection of a point-count survey was not entirely efficient on the field. That is why interesting information on the species behavior has been recorded and could help for a better detection rate of the species in the future. Characterizing the species habitat was also important, as unfavorable habitat was recorded before and after the fieldwork so as to focalize in certain areas of the island.

The identification of the dangers is another achievement. Feral cats can be a great danger since they climb trees and kill the birds. The presence of rats is a problem because of competition for food, since rats eat lizards and insects too. This was also observed in Niau, with the Tuamotu Kingfisher (Coulombe et al., 2009).

The Great Horned Owl was described and the sound recording heard by the population so that they are aware of this species. The fact that this species could seriously endanger the M. Kingfisher population was discussed.

The mayor said he would talk to the population about the protection measures that would be put in place for *T godeffroyi* in the future. The population has to be encouraged not to cut or burn dead trees. Without these trees, the M. Kingfisher would have real difficulties in the future to find a suitable nest. This is especially true in coconut plantations where the dead trees need to be kept.

Another important measure is to preserve as much of the forest as possible. The local population of Tahuata (700 inhabitants) has been increasing. Land use for agricultural activities on the island can have a major impact on the bird population. Previous forest fires were accidental and need to be controlled. Depending on the forest recovery, it can also affect the species territories.

The mayor assured us that he would help in the future projects that are planned to protect this particular species. The local guide is well known in the community, and he will also continue to communicate the importance of this species to the island inhabitants.

Talking to the children was an important process since the future of the species clearly depends on the future generations. This educational method has been proven to be successful for previous projects on other islands and should be successful on Tahuata Island.

Section 3: Future recommendations for Marquesan Kingfisher conservation

Conclusion

There are several important conclusions gained from the study of the Marquesan Kingfisher.

Firstly, it seems that since 2003, the population trend has declined. The whole population is estimated to be about 451 individuals [401-484]. It may be a consequence of the increase of the local population, changes in their habitats, as well as the impacts of human activities and pests. The knowledge of *T godeffroyi* was improved by studying behavior, nest and territory requirements.

The Great Horned Owl seems to be absent. However the presence of rats and feral cats were determined during this fieldwork.

Methods of detection has to be adapted to the species in the future since 10 minute point-count do not seem to be the most effective. If this method is maintained, increasing the number of visits and the given time on these sites could be another option. Four field trips are planned for 2012 and 2013 to increase the knowledge on the species and habitat repartition (Ghestemme com. Pers.)

Finally, involving the community, in the protection of the M. Kingfisher, is essential for its conservation. Establishing contacts with the Ornithological Society of Polynesia "Manu" organization is beneficial for the population as well as for the species protection. Conserving dead trees and the native forest of Tahuata determines the species future. Talking to the children was important for the species protection since they are the future generation of Tahuata Island.

Problems encountered and lessons learnt

- The projects activities and the outcomes achieved were the determination of the population trend, the characterization of the species habitats, the identification of pests and involvement of the community in the conservation of the M. Kingfisher. Most of the point-counts of 2003 were visited, with individuals that were successfully assessed. Identifying the habitats on a satellite map was really useful, and prevented us from wasting time on certain parts of the islands, not occupied by the M. Kingfisher.

The identification of pests was very effective. The presence of rats and feral cats on the island were clearly determined and could explain why the population of M. Kingfisher is declining.

Finally, involving the local community has been essential for the project. They were very helpful when searching for the M. Kingfisher territories. Making the population interested in their fauna was an important step in conservation. Discussing with them about the species means that the future protection and survival would be ensured. We encouraged them not to cut or burn dead trees, as this practice could be the main reason for species decline.

- An important problem that was encountered was with the point-count survey. *T. godeffroyi* was really difficult to detect. The data was then sparse and, in consequence, the software Presence provided unsatisfactory results. Instead of using the Royle point-count model, we had to use the False-Positive occupancy model. It appears that 10 minutes point-count is not enough for the detection of this species.

Another problem was the nest age determination. It was difficult to conclude that a nest was recent or ancient, that is if it had been occupied or not. Only determining the species of tree seemed relevant here. Maybe recording the attempts would have increased our data.

- The specific methodologies and conservation tools were, for *T godeffroyi*, a point-count surveys and mapping. Nests and habitats were also reported and marked on the maps. For the rats, a line of 40 traps and for the feral cats, a faeces survey was done. The individuals of feral cats that were seen or heard during the point-counts were also recorded. For the Great Horned owl, night surveys (2 nights- 4hours) were carried out. Finally, discussions using PowerPoint presentations were carried out with the community and the school children of Vaitahu.
- The important lessons that were gained on this project involved bird monitoring such as the methods to survey a bird population effectively. In addition we used different ways to involve people. Getting well-respected locals like the mayor and the guide (who spoke Marquesan) made it easier to communicate the work and discuss conservation issues. In the future, the time spent on the fieldwork has to be lengthened to gain better understanding of the situation. Increased surveys on a site or using a different detection method especially adapted to the M. Kingfisher are also recommended.

In the future

In the future, several conservation measures need to be planned for the M. Kingfisher study and conservation. Next year, another project is planned for this species and some activities can already be considered such as improving the point-counts survey, maybe even banding some individuals. Because this species has a really low detection probability, either the visits on the point-counts needs to be doubled or the methodology needs to be adapted to this species. Perhaps one-hour point counts need to be done instead of 10 minute point counts. The period for the fieldwork could to be changed as well.

Traps may be also used to reduce the numbers of feral cats. Furthermore the presence of the Great Horned Owl needs to be verified, as it would be a possible threat.

Keeping contacts with Tahuata is important, especially with the mayor and the local guide, who have been really cooperative during this mission. The main aim for the future is to persuade the local population to help in the protection of this species. Economical profits that they could be gained with the conservation of this species need to be proposed. The locals could be encouraged to have the Marquesan Kingfisher as the symbol of Tahuata Island. The SOP Manu is already planning to train a local guide for the birds of Tahuata and this will allow ornithological tourism. Other ideas to involve the people would be to create posters that would be translated into Marquesan, Tahitian and French and could be distributed to the schools and the public. Local art events, where painting, handcraft and dances with the Marquesan Kingfisher and other marquesan birds as a theme would be a good idea.

Section 4: Field raw data and PowerPoint presentations for the local community

Appendix 1: Raw Data T godeffroyi (Point-count survey and outside point-count "P")

Place/	Sites	1	2	3
Dates		5/12/11	14/12/11	22/12/11
Vaitahu valley	1	0	0	0
Vaitahu valley	2	0	0	0
Vaitahu valley	3	0	0	0
Vaitahu valley	4	0	0	0
Vaitahu valley	5	0	0	0
Vaitahu valley	6	0	0	0
		6/12/11	13/12/11	16/12/11
Hapatoni (rd)	7	0	0	0
Hapatoni (rd)	8	0	0	0
Hapatoni (rd)	9	0	0	0
Hapatoni (rd)	10	0	0	0
Hapatoni (rd)	11	0	0	0
Hapatoni (rd)	12	0	0	0
Hapatoni (rd)	13	0	0	0
Hapatoni (rd)	14	0	0	0
Hapatoni (rd)	15	0	1	0
Hapatoni (rd)	16	0	0	0
Hapatoni (rd)	17	2	0	0
Hapatoni (rd)	18	0	0	0
Hapatoni (rd)	19	0	0	0
Hapatoni (rd)	20	0	0	0
		8/12/11		
Hanatuuna (bay)	21	0	1	0
Anaete (bay)	22	0	1	0
Anaete (bay)	23	0	2	2
		10/12/11		
Hanamoenoa (bay)	24	0	0	0
		9/12/11	12/12/11	17/12/11
Motopu (rd)	25	0	1	0
Motopu (rd)	26	0	0	0
Motopu (rd)	27	0	0	0
Motopu (rd)	28	0	0	0
Motopu (rd)	29	0	0	0
Motopu (rd)	30	0	0	0
Motopu (rd)	31	0	0	0
Motopu (rd)	32	1	0	0
Motopu (rd)	33	2	0	0
Motopu (rd)	34	2	0	0
Motopu (rd)	35	0	0	0
Motopu (rd)	36	0	0	0
Motopu (rd)	37	0	0	0
Motopu (rd)	38	0	0	0
Motopu (rd)	39	0	0	0
		10/12/11		
Hanahevane (bay)	40	0	0	0

Hanahevane (bay)		41	0	0	0
Hanamenino (bay)		42	0	0	0
Hanamenino (bay)		43	0	2	0
			12/12/11	14/12/11	16/12/11
Vaitahu (rd)		44	0	0	0
Vaitahu (rd)		45	1	0	0
			15/12/11	19/12/11	
Hanatetena (rd)		46	0	0	-
Hanatetena (rd)		47	0	0	-
Hanatetena (rd)		48	0	0	-
Hanatetena (rd)		49	0	0	-
Hanatetena (rd)		50	0	0	-
Hanatetena (rd)		51	0	0	-
Hanatetena (rd)		52	0	0	-
Hanatetena (rd)		53	0	0	-
Hanatetena (rd)		54	0	0	-
Hanatetena (rd)		55	0	0	-
Hanatetena (rd)		56	0	0	-
Hanatetena (rd)		57	0	2	-
Hanatetena (rd)		58	0	0	-
Hanatetena (rd)		59	0	0	-
Hanatetena (rd)		60	0	0	-
Hanatetena (rd)		61	0	1	-
Hanatetena (rd)		62	0	0	-
Hanatetena (rd)		63	0	0	-
Hanatetena (rd)		64	2	0	-
Hanatetena (rd)		65	0	0	-
			21/12/11		
Hanahio (bay)		66	0	1	0
Oehau (bay)		67	0	1	2
Outside point-count survey					
Vaitahu (rd)	P1 (12/12/2011)		1		
Hapatoni (rd)	P2 (12/13/2011)		1		
Hapatoni (rd)	P3 (12/13/2011)		1		
Hanatetena (rd)	P4 (12/15/2011)		2		
Hanatetena (rd)	P5 (12/15/2011)		1		
Hanatetena (rd)	P6 (12/15/2011)		1		
Vaitahu (valley)	P7 (12/1/2011)		1		
Anapoo	P8 (12/6/2011)		1		
Hapatoni (rd)	P9 (12/6/2011)		1		
Hanatetena (rd)	P10 (12/20/2011)		1		
Hanatetena (rd)	P11 (12/20/2011)		1		
Vaitahu (rd)	P12 (12/16/2011)		3		
Motopu (rd)	P13 (12/17/2011)		1		
Vaitahu (valley 2)	P14 (12/7/2011)		2		
Vaitahu (valley 2)	P15 (12/7/2011)		1		

Appendix 2: Raw data Rats

Rats	Specie	Trap	Gender	Ear	Tail	Body
1	Rattus exulans	4	Female	16.3	14.9	11.5
2	Rattus exulans	17	Female	17	24.5	12
3	Rattus exulans	8	Male	17.5	14	24.7
4	Rattus rattus	22	Female	21.6	16.5	22.7
5	Rattus exulans	5	Male			
6	Rattus exulans	21	Male			
7	Rattus exulans	14	Male			
8	Rattus exulans	28	Male			
9	Rattus exulans	8	Male			
10	Rattus exulans	15	Female			
11	only a tail					
12	Rattus exulans					
13	Rattus exulans					
14	Rattus exulans					

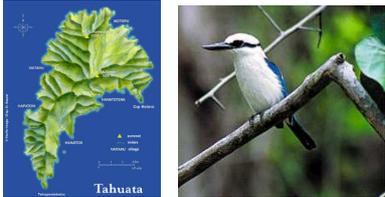
Appendix 3: Raw Data Nests (also see map 2)

Nest		
0	Ehi (Cocos nucifera)	
1	Fara (Pandanus tectorius)	
2	Fara (Pandanus tectorius)	
3	Unknown (too old to be indentified)	
4	Ora'a (Fixus prolixa)	
5	Purau (Hibiscus tiliaceus)	
6	Fara (Pandanus tectorius)	
7	Fara (Pandanus tectorius)	
8	Uru (Artocarpus altilis)	
9	Fara (Pandanus tectorius)	

Appendix 4: PowerPoint presentation (adults)

1/3

Protection du Pahi
Tahuata



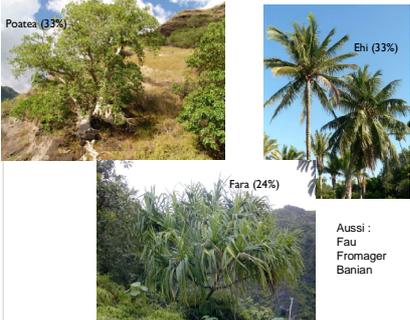

Le Pahi vit dans un territoire de 6 hectares et mangent des insectes et des lézards



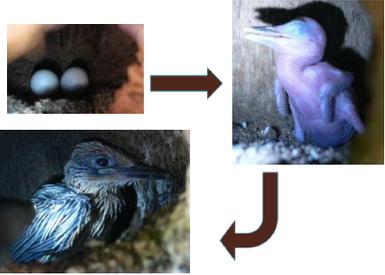

Il niche dans les troncs d'arbres



Poatea (33%)
Ehi (33%)
Fara (24%)
Aussi :
Fau
Fromager
Banian



Cycle de reproduction d'un Pahi



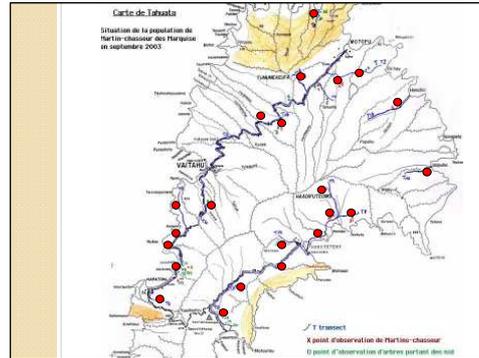
Pourquoi ce programme ?

- Le Pahi a déjà disparu de Hiva oa (années 80)
- La dernière étude à Tahuata était en 2003
- Il est en danger d'extinction



Etude du Pahi

- Estimation du nombre de Pahi
- Etude de la répartition de l'oiseau
- Etude de l'évolution de la population
- Evaluation des dangers qui le menace
- Sensibiliser les habitants à la préservation de l'espèce



Les dangers qui menacent le Pahi?



Les oiseaux introduits



Grand Duc d'Amerique



Merles des Mollèques

Les autres menaces



Chats



Rats

Les autres menaces : Le Feu et la coupe des arbres morts



Que faire pour protéger le Pahi?

- Ne pas couper ou brûler les vieux arbres
- Ne pas amener de chats dans le fa'a'a pu
- Si le Hibou est présent, il faut l'éliminer
- Ne pas transporter de Merles depuis Atuona



Vaieinui

Appendix 5: PowerPoint presentation (children)

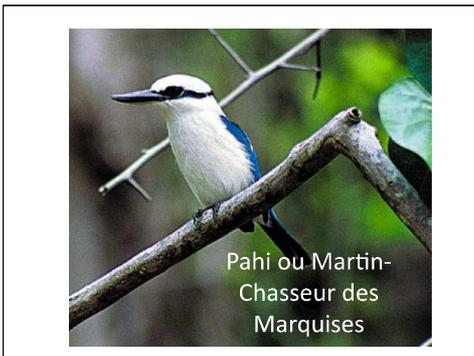


Qu'est ce qu'un OISEAU ?

- Il a 2 pattes et 1 bec
- Il a des plumes
- Il vole
- Il pond des oeufs

Quels sont les oiseaux de Tahuata ?

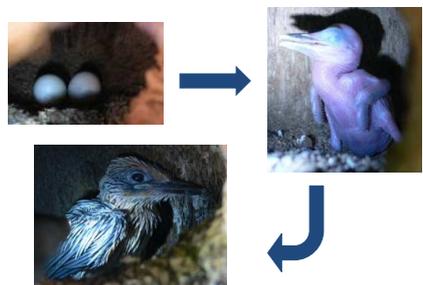




Il niche dans les arbres



Cycle de reproduction



Pourquoi s'intéresse-t-on à lui?

- Il n'existe qu'à Tahuata
- Il a déjà disparu de Hiva oa
- C'est devenu une espèce rare
- Il peut disparaître si on ne fait rien pour le protéger.



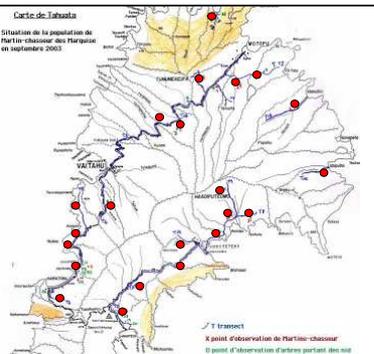
Les Menaces



Grand Duc d'Amérique



Merles des Moluques



Les Menaces



Chats



Rats

Les Menaces

Le Feu

La coupe des arbres morts



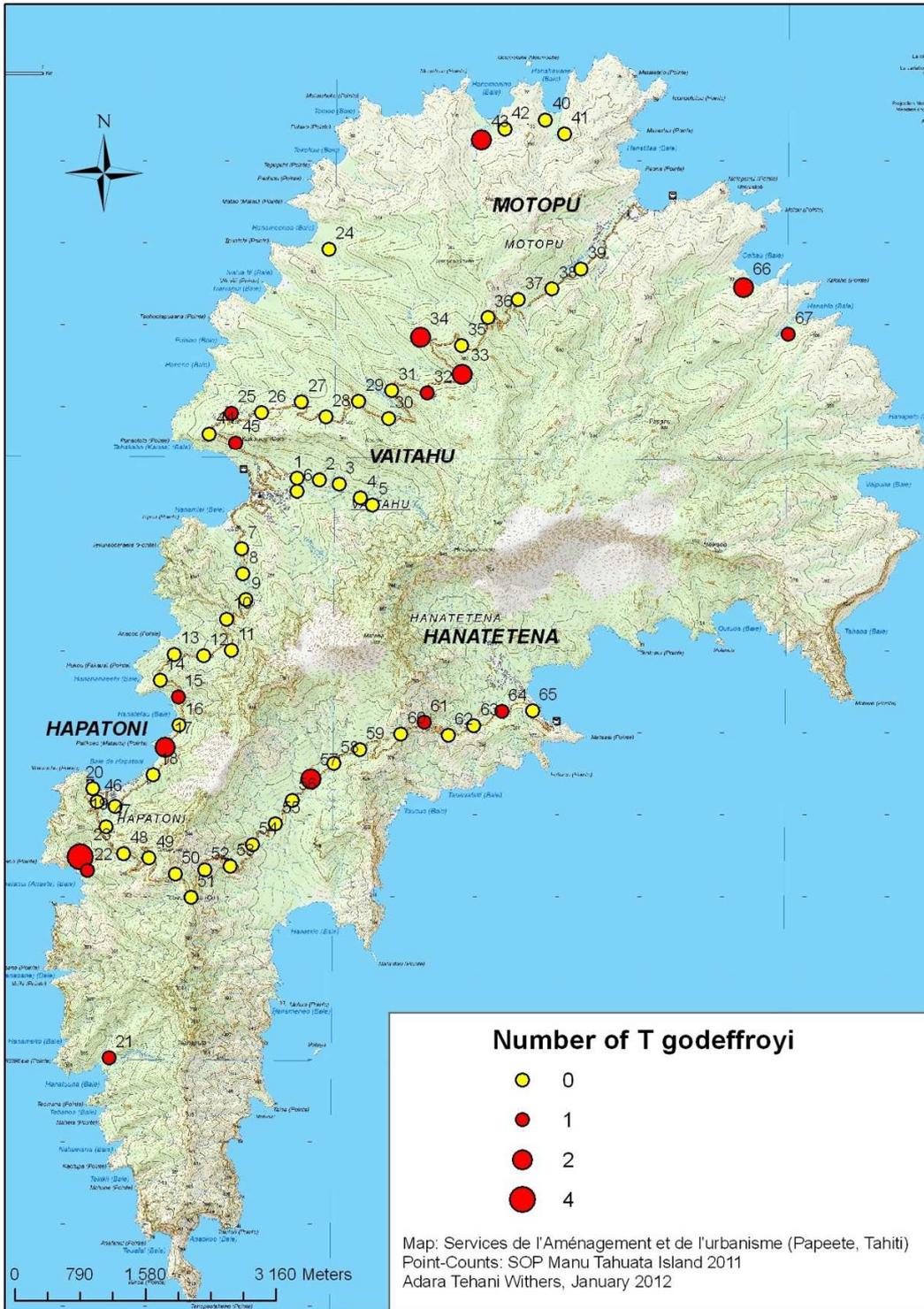
Qu'est-ce que vous pouvez faire?

- Dire à vos parents que vous ne voulez pas que le Pahi disparaisse
- Dire à vos parents de ne pas couper ou brûler les arbres morts

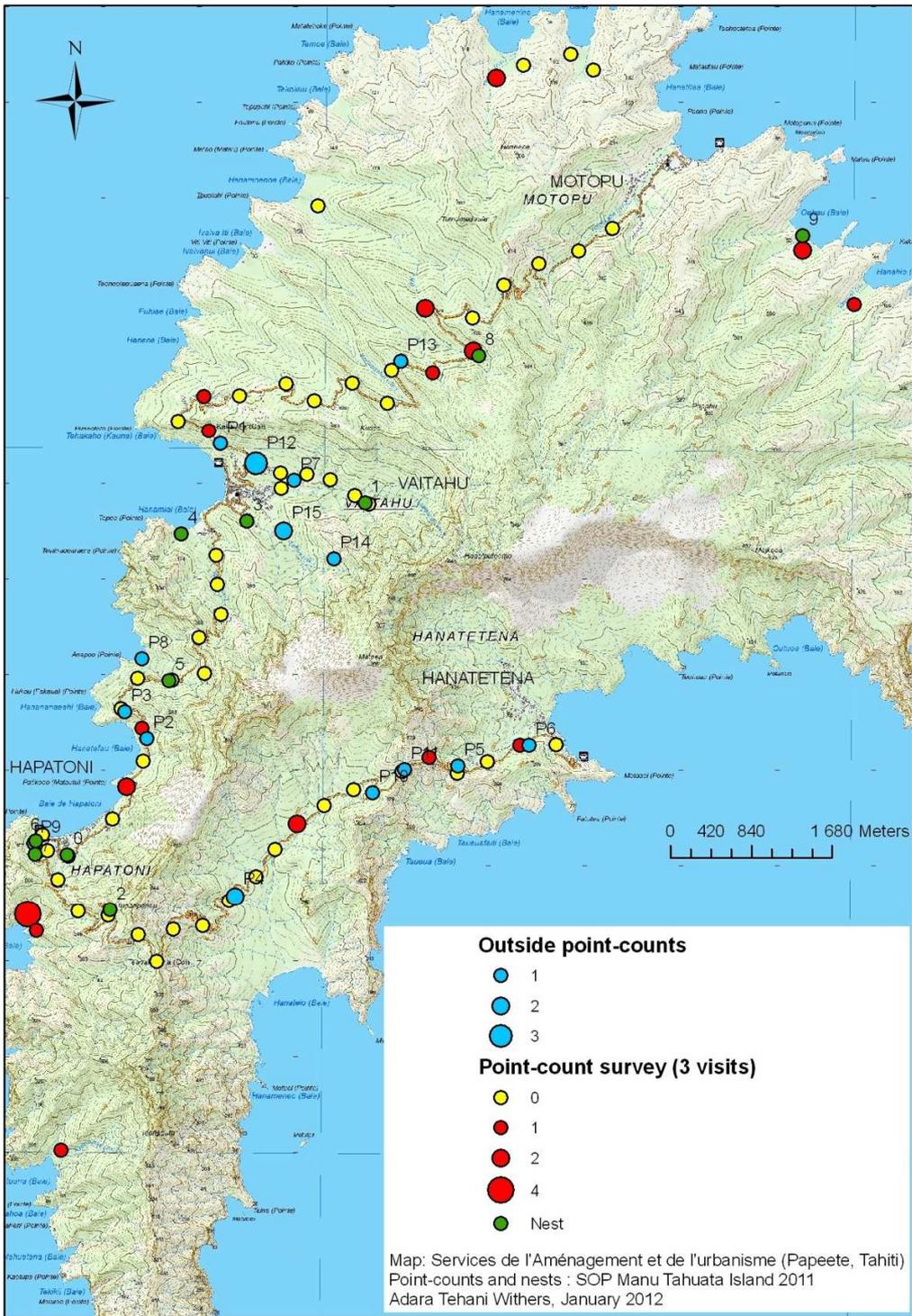


Vaieinui les
enfants!

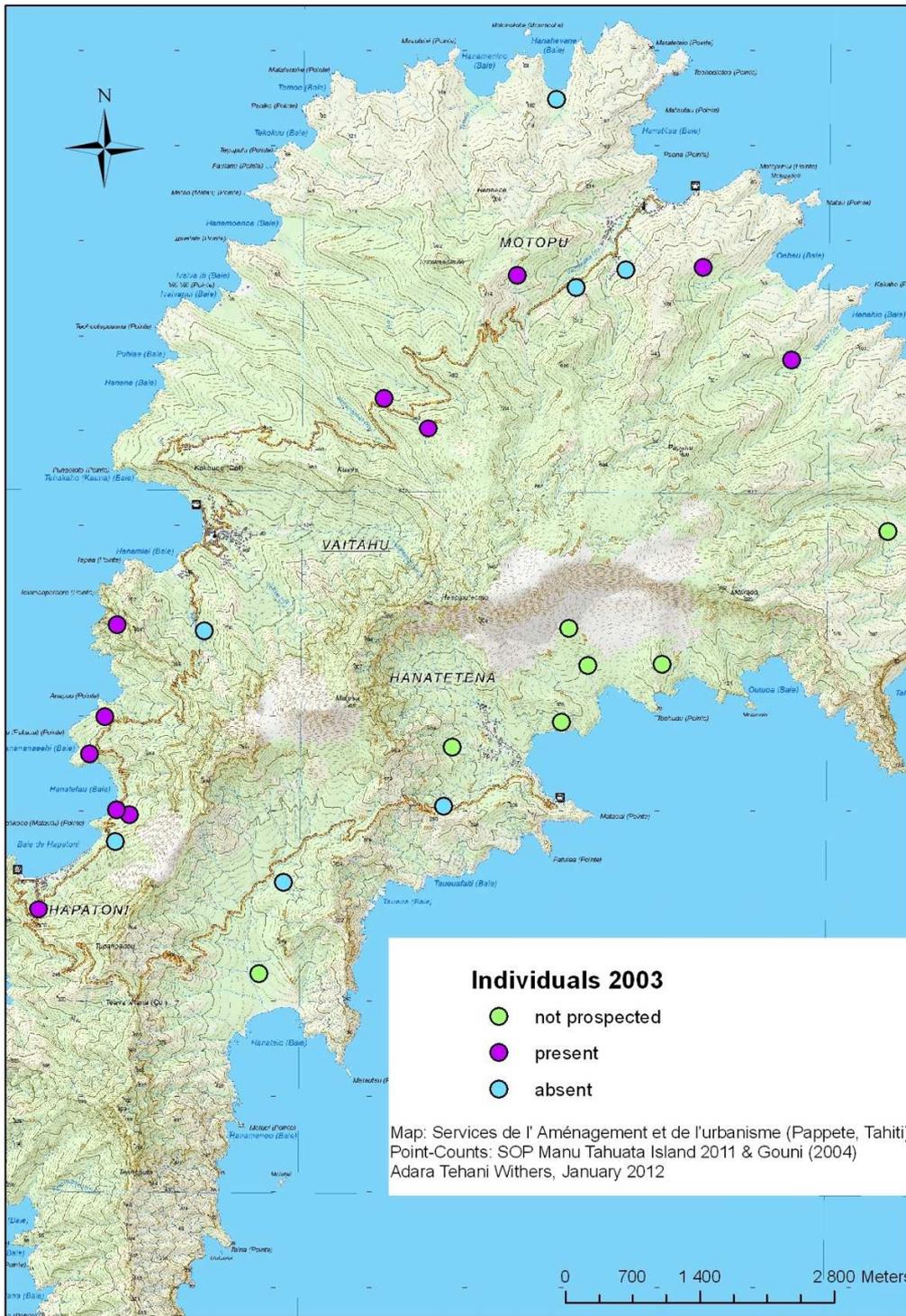




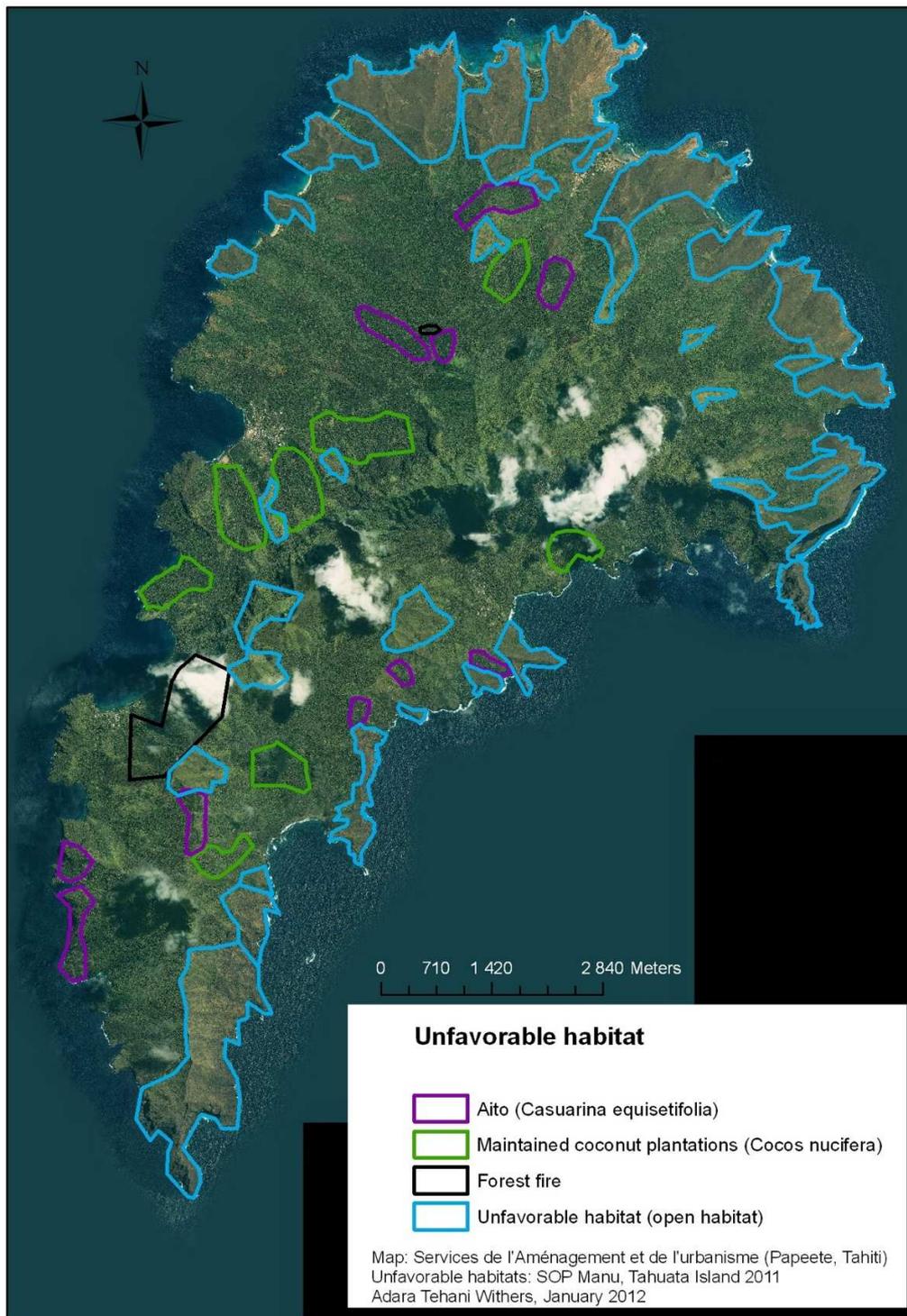
MAP 1: Marquesan Kingfisher Point-Count survey (3visits), Tahuata 2011



MAP 2: Marquesan Kingfisher individuals and nests, Tahuata 2011



MAP 3: Marquesan Kingfisher Population Evolution since 2003, Tahuata 2011



MAP 4: Marquesan Kingfisher unfavorable habitats, Tahuata 2011

Appendix 6:

- Article that was published in the local newspaper and website:

http://www.tahiti-infos.com/Tahuata-Dernier-refuge-du-Pahi-ou-Martin-Chasseur-des-Marquises_a40716.html

- Article for the "Te Manu" ("The Bird" in Te Reo Maohi, Tahitian language), which is the quarterly report of the SOP Manu. It is published in French and sent to all members of the SOP Manu association. An article on the Marquesan Kingfisher is in completion, and will be published in the next report (February-March 2012).
- Adara Tehani WITHERS internship report for Waikato University- will be completed and graded in June 2012

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Presence and MARK software forum: <http://www.phidot.org/>

French Polynesia environmental code: <http://www.environnement.pf/spip.php?rubrique45>

Other websites on Presence:

<http://www.mbr-pwrc.usgs.gov/software/presence.html>