

- Since 2019, towns on Martinique have been divided into two zones:
 - a strategic zone for the conservation of *Iguana delicatissima*, called the "PNA zone" and managed by ONF;
 - a strategic zone for the preservation of human activities, called the "PLIC zone" and managed by DEAL.
- To effectively manage the species, different approaches are used by the PLIC and PNA agents in order to maximise the chances of success. The management strategies depend on the given sector.

Table 1. Management strategy for striped iguanas in each sector.

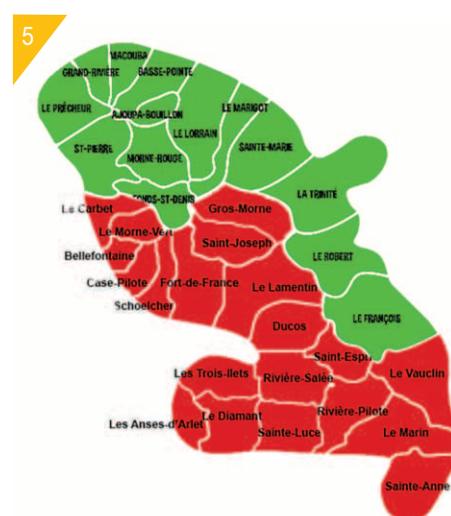
Objectives	Action plan and corresponding zone	Network manager	Management strategy				
			Removal of iguanas			Surveillance network and training	Awareness raising of population and elected officials
			Large-scale management	Isolated efforts (while waiting for large-scale management)	In response to reports		
Limit the expansion of <i>I. iguana</i> to the north of Martinique and to Chancel Island	PNA	ONF	NO	NO	YES	YES	YES
Manage high-density <i>I. iguana</i> populations in urban areas	PLIC	DEAL	Future project	YES	YES	YES	YES

■ Capture and killing

- Striped iguanas are captured using a long fishing pole with a slip knot (stainless-steel wire or string) at the end.
- Iguanas captured using the pole are then grabbed by an agent with gloves to avoid any risk of wounds and infection. Animals are placed in a bag (one animal per bag) to facilitate their transport to where they are to be put to death within a maximum of four hours following capture.
- Killing takes place with the iguana in a holding box, using a pellet gun (19.9 joules) that does not require a hunting license or a permit to carry.
- The procedure requires two agents, one to maintain the iguana in the holding box and the other to shoot the gun. Protection goggles are required for both agents. The muzzle of the gun is placed behind the skull next to the small dorsal spines, at an angle of 20 to 30° to ensure an instantaneous death without any unnecessary suffering.

■ Isolated interventions and large-scale management

- In the PLIC (red) zone, isolated interventions are undertaken by teams of three to six agents comprising public-service personnel (Martinique Regional Nature Park [PNRM], DEAL, French Biodiversity Agency [OFB] and ONF) and private partners in areas where *I. iguana* is found in high densities. During each intervention, whenever possible, all the animals observed in a high-density sector are captured and put to death. Isolated interventions slightly reduce local populations



5 - Division of towns according to the objective selected by the network managers (PNA zone in green and PLIC zone in red). Source: Carbet des sciences, DEAL and ONF.

in order to limit the expansion of striped iguanas to the northern section of the island. In parallel, inhabitants are informed of the problem with the striped iguanas.

- To date, large-scale management efforts have not been undertaken, however project managers have been encouraged to do so. The large-scale strategy is considered the most effective in limiting the population of striped iguanas in the centre of the island, outside of the priority sectors for the conservation of the Péyi iguana. Large-scale management is therefore intended for the PLIC zone and DEAL is ready to assist project managers in the procedure.

■ Surveillance network and response to reports

- Their propensity to live in trees, stealthy behaviour and camouflage make it difficult to detect isolated animals.

- The response to reports by inhabitants makes it possible to work on private property, often less accessible during isolated interventions.

- Surveillance networks have been set up to receive reports from the population and organise the capture of the detected animals:

- PLIC (red) zone: the network is composed of local-government personnel and private partners in order to react to the reports by inhabitants;

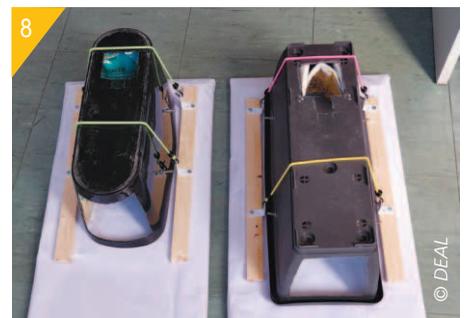
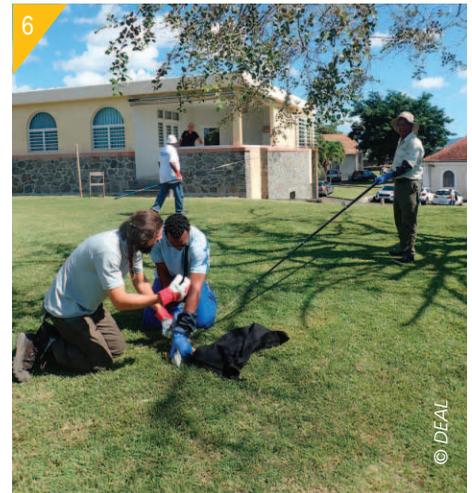
- PNA (green) zone: the network is composed of local-government personnel, the gendarmerie, fire departments and volunteers from non-profits to receive the reports on *I. iguana* and to capture the animals detected in areas only slightly invaded and considered priority zones for the conservation of *Iguana delicatissima*.

- Members of the surveillance network have undergone training on the issues involved in managing *I. iguana* and on the criteria to differentiate between the two species, as well as practical training on the techniques used to capture, handle and kill the animals. Between 2017 and 2020, depending on the targeted sectors, several training courses have been organised by ONF and DEAL. A total of 69 people have been trained, including 14 for PNA activities and 55 for PLIC activities. The trained persons are included in the appendix to the prefectural order that lists the persons authorised to capture and kill striped iguanas. The appendix is updated in step with the training courses.

- On written request by a mayor or president of an EPCI (public entity for cooperation between townships), capture equipment for towns or capture and lethal equipment for EPCIs can be made available to PLIC towns and EPCIs by DEAL (budget available at times) and to PNA towns by ONF. To date, only the town of Fort-de-France possesses the equipment. However, municipal police are authorised to take action and all towns can thus respond to reports.

- A telephone call group comprising all the trained persons was created by the network manager in order to facilitate the coordination of responses to reports.

- For Martinique as a whole and the PLIC zone in particular, it is also possible to fill out an on-line report form on the DEAL site to signal the presence of an IAS, including striped iguanas. DEAL then transmits the report to the local government or the private partner in charge of responding to the report. The call group is not used in the PLIC zone because there are too many reports and the response would not be improved.



6 - Capture of a Striped iguana using the pole with a slip knot.

7 - End of the pole showing the slip knot.

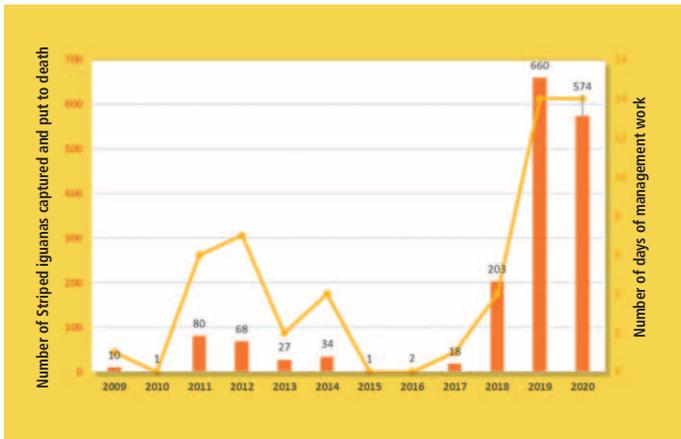
8 - Holding box designed specifically for putting striped iguanas to death. Two sizes are available for different sized animals.



Results

■ Technical results

■ Striped iguanas have been captured since 2009, but it was in 2011, in the framework of the PNA to restore the Lesser Antillean iguana (2011-2015), managed by ONCFS, that coordinated management efforts started. The work halted in 2015 and 2016 due to the lack of a PNA manager during the transfer from ONCFS to ONF. In 2017, management work was relaunched and even increased given the need to limit the expansion of the Striped iguana on Martinique.

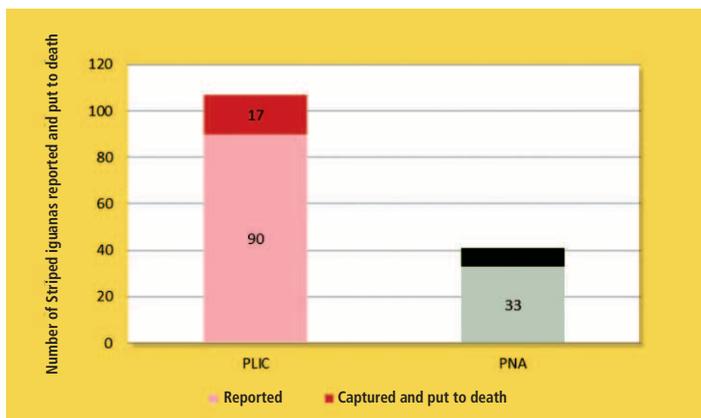


Number of striped iguanas (l. iguana) captured and put to death, and the number of days of management work from 2009 to 2020.

■ Isolated interventions take place essentially in Fort-de-France. The interventions organised outside of Fort-de-France often did not produce the expected results in spite of the significant resources involved (six agents, but no iguanas captured). That is why the creation of the surveillance network was deemed better suited to areas not heavily invaded by striped iguanas.

■ Since the start of the management work, 1 682 striped iguanas have been culled, including 1 640 in Fort-de-France, 14 in PNA towns and 28 in towns in the PLIC zone.

■ A total of 123 striped iguanas have been reported by the surveillance network or by citizens, including 33 in PNA towns and 90 in towns in the PLIC zone. On the whole, only 24% and 19% of reports, respectively in the PNA zone and the PLIC zone, resulted in the capture and killing of iguanas. This is because between the time of the report and the intervention, iguanas frequently move and are not found.



Breakdown of the numbers of l. iguana reported and put to death.



9 - Capture of a Striped iguana during a practical training course in Fort Saint-Louis.

10 - A captured Striped iguana.

■ Financial aspects

■ Management work on the Striped iguana on Martinique in the framework of the ONF and DEAL projects cost approximately 120 000 euros (ONF, DEAL, AFB, MIGBIO).

Table 2. Management costs of the ONF project.

Year	Equipment	Personnel	Total
2017	2 060 €		2 060 €
2018	2 648 €	11 423 €	14 071 €
2019	4 511 €	51 238 €	55 749 €
2020	4 346 €	26 796 €	31 142 €
Total	13 565 €	89 457 €	103 022 €

Table 3. Management costs in the DEAL project.

Year	Management work	Personnel
Mid 2018 to Sept. 2020	/	5% of an annual full-time job
Sept. 2019 to end of 2020	15 000 €	33% of an annual full-time job

Information on the project

■ Given the lack of knowledge on the part of inhabitants concerning the two species of iguana, the invasive nature of the Striped iguana and in the meantime before greater awareness can be achieved, it was decided not to make this project widely known via the media and the social networks. Intervention personnel inform the general public as much as possible on the situation and the issues involved during work to capture the animals.

■ In certain areas of Fort-de-France, e.g. Texaco and Volga, the density of striped iguanas is very high and their impacts on gardens, crops and fruit trees are considerable and visible. Local citizen groups and individual citizens have begun to request that local governments intensify the work to limit the numbers of iguanas.

■ The informational caravan on the péyi iguana is operated by the non-profits in the network for the Lesser Antillean iguana each year during various events (patron saint fiestas, science days, etc.) (see the management report. on the caravan). A kakemono (vertical banner) titled "The Striped iguana, the main threat, but not the only one" is displayed by the presenters who attempt to raise awareness on the need to manage the invasive species in order to save the Péyi iguana and to limit the health and economic impacts. A kakemono titled "Help in preserving biodiversity on Martinique!" highlights the need to "multiply the number of watchful eyes" for the network for the Lesser Antillean iguana and to rapidly report any striped iguanas in the priority towns of the PNA zone. During two days of management work in busy public areas in Fort-de-France (February and March 2020), the informational caravan was on hand to explain the work to pas-



sers-by while the agents were capturing the iguanas. The caravan presenters noted a high majority of positive reactions on the part of persons informed as to the purpose of the management work.

- Letters were sent to elected officials to inform them on the issues involved, explain the need for the management work and justify the management strategy selected for each part of the island. A number of information meetings were also organised by the regional nature park and DEAL for elected officials from the towns and EPCIs. Participants were informed on IAS issues and more specifically on the need for management of the Striped iguana to save the Péyi iguana. They are now in a position to answer the questions of inhabitants on a range of topics (regulations, techniques used to capture and put to death the animals, organisation of the surveillance network to respond to reports, etc.).

- The techniques used to capture and put to death the animals were presented during the regional IAS workshop organised by the IUCN French committee in February 2020 that brought together all the overseas stakeholders confronted with the problem.

Potential improvements

■ Maintain the existing surveillance network and continue informing and mobilising the towns and EPCIs in order to develop the surveillance network and ensure a response to reports

- In the PNA zone, it is imperative to maintain the surveillance network with the call group in order to respond rapidly to reports of striped iguanas in priority areas for the conservation of the Péyi iguana.

- In the PLIC zone, it is important to continue distributing equipment in 2021 so that the EPCIs, towns and private partners can easily and quickly respond to reports. Management work by individual towns in the EPCIs is also expected to start in 2021.

■ Better assess the effectiveness of isolated interventions and large-scale management

- Following several interventions in high-density areas, the rapid reduction in the numbers of striped iguanas is clear. However, it is still necessary to assess the effectiveness of these isolated interventions.

- An estimation of the number of animals using the distance-sampling method was carried out in 2020 to obtain baseline data for an assessment of the effectiveness of the management work in the port sectors of Fort-de-France. The resulting estimate of abundance was 723 striped iguanas (confidence interval = 387 to 1 350), i.e. a density of 3.96 iguanas per hectare. This estimate represents the initial data point for iguana densities. New counts before and after future management work with differing time lapses between each count (one week, one, two, four or six months, one year) will make it possible to measure the changes in the numbers of striped iguanas and to assess the effectiveness of the management work.



11 - Informational caravan for the conservation of the péyi iguana, set up in Fort-de-France.

■ Improve the effectiveness of management work

■ Current management work on the Striped iguana is not sufficient to achieve a sustainable drop in numbers and reduce the risks of interbreeding with the populations of the Lesser Antillean iguana because interventions remain isolated and produce only local effects.

■ On Grand Cayman Island, the government launched in October 2018 a management programme involving 467 licensed companies and individuals who receive the equivalent of four to five euros for each iguana put to death. The iguanas are captured using a long pole and then put to death, or they are simply shot using a pellet gun. In 2019, the programme eliminated approximately 1.1 million striped iguanas. In 2020, fewer than 100 000 iguanas remained on the island.

■ This programme is one of the very few that resulted in a significant reduction in the population of *I. iguana* on an inhabited island. One of its strong points is that it is relatively inexpensive compared to management work done by public-sector employees. Adapting the programme to Martinique would require a significant effort to raise the awareness of inhabitants in order to avoid hostile reactions, a study on its feasibility in terms of local regulations and suitable training for participants to avoid unnecessary suffering of the animals when being captured and put to death.

■ Large-scale management efforts are required to ensure effective reductions in numbers. DEAL plans to accompany project managers (EPCIs, the regional nature park, non-profits, etc.) in preparing applications for funding and greater human resources for larger operations.

■ In parallel, a study will be launched to identify other management techniques. For example, work will be put into detecting and eliminating nests. This would be a more effective technique because 30 to 60 eggs can be eliminated in each nest. This work is planned for the nesting period (April 2021), notably in and around Fort Saint-Louis.

■ Valorise the animals put to death in order to improve acceptance of the work by the general public

■ The issue of valorising the iguanas put to death was raised by over 95% of the persons informed by the caravan. This would appear to be a highly important point because, according to these persons, an effort to make use of the animals, particularly by consuming the meat, would facilitate acceptance of the management work by inhabitants. Work will have to be undertaken locally with the Directorate for Food, Agriculture and Forestry (DAAF) to study this possibility. To date, the animals are not valorised and the bodies are simply sent to the local rendering service. This solution is currently acceptable, however it would certainly be worthwhile to study valorisation possibilities (meat, leather). To that end, ONF and DEAL have launched discussions with DAAF. It would also be worthwhile to run a study on current knowledge concerning pathogens potentially carried by striped iguanas.



Regulations

- The introduction of the Striped iguana in the natural environment is prohibited by the ministerial decree dated 8 February 2018 on preventing the introduction and propagation of animal IASs in the natural environment of Martinique.
- The species is also on the list appended to the ministerial decree dated 7 July 2020 prohibiting the introduction, detention, transport, use and/or trade of IASs on Martinique.
- The species is named in the prefectural order dated 8 July 2013 authorising the capture and killing of certain IASs by certain competent organisations and professional sectors.
- The prefectural order dated 22 August 2019 authorises a specific list of non-profits, local governments and private structures to capture and kill striped iguanas. The appendix to the order is updated in step with the training courses.

Authors: Fabian Rateau, National Forestry Agency in Martinique, Julie Gresser DEAL Martinique, Clara Singh, IUCN French committee, Alicia Bonanno, National Forestry Agency in Martinique, Marie-Laure Rizzi, DEAL Martinique, Clarisse Courty, DEAL Martinique, for the IAS Resource Centre in conjunction with the Overseas IAS Initiative. April 2021. Editor: French Biodiversity Agency.

This management report fills out the collection already published in the second and third volumes of the book titled "Invasive alien species in aquatic environments, Practical knowledge and management insights", in the Knowledge for action series published by the French Biodiversity Agency.

<http://especes-exotiques-envahissantes.fr/best-practices-guide/?lang=en>

En savoir plus...

- Angin B., 2017. National action plan to restore the Lesser Antillean iguana, *Iguana delicatissima*, 2018-2022. Ardops Environnement, 67 pp + appendices. (In French)
- Angin B., 2018. Action plan against the green iguana (*Iguana iguana*) in the French Caribbean 2019-2023. ONCFS and Ardops Environnement, 71 pp + appendices. (In French)

<https://www.facebook.com/iguanadelicatisima>

<http://www.martinique.developpement-durable.gouv.fr/iguanes-a1417.html>

<http://www.martinique.developpement-durable.gouv.fr/reglementation-a1462.html>

<http://www.martinique.developpement-durable.gouv.fr/j-ai-observe-une-espece-envahissante-a1466.html>



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