



Newsletter 9

June 2022

Project carried out by

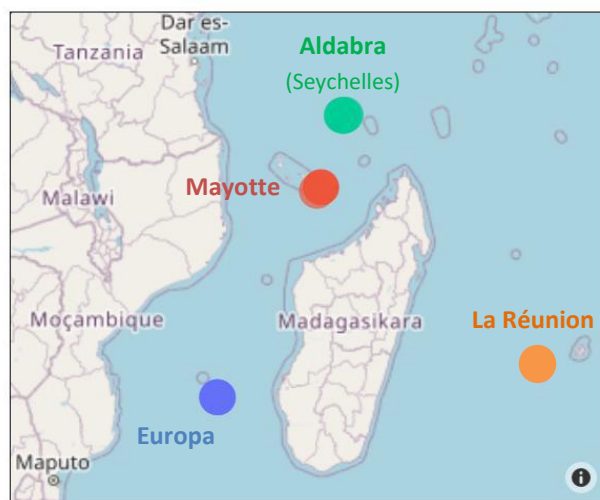


In partnership with



RESULTS

Started at the end of 2018-beginning of 2019, the "Indian Ocean sea Turtles" (IOT) project carried out by the Indian Ocean delegation of Ifremer in collaboration with the Montpellier Laboratory of Computer Science, Robotics and Microelectronics (LIRMM-CNRS), the Seychelles Islands Foundation (SIF) the French Southern and Antarctic Lands (TAAF), the Mayotte Departmental Council, the Mayotte Natural Marine Park (PNMM-OFB) and Oulanga Na Nyamba, has made it possible, after several years of research, to develop a **new generation of** innovative, low-cost **tags** that are adapted to the questions of scientists. Developed to monitor the movements and behaviour of juvenile green and hawksbill turtles within the framework of this project, these tags could in future be deployed on other marine animals.



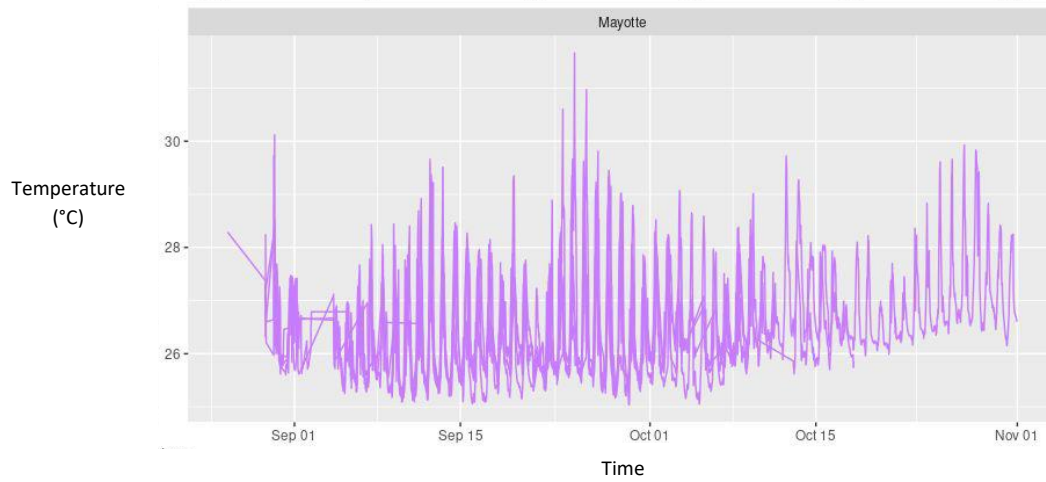
Forty IOT tags using the LoRa (Long Range) transmission system based on connected object technology were deployed on turtles in **Europa** (Eparses Islands), **Mayotte**, **Reunion Island** and **Aldabra** (Seychelles). A solar version with solar panels was even produced and tested on a turtle from Europa (shallow lagoon) to increase the battery life of the tag. Several **receiving stations** have also been installed at certain sites, allowing scientists to receive data whenever a turtle comes to the surface to breathe. In order to ensure this link, satellite stations were set up on the most isolated sites that do not have an internet connection. At the same time, the project was able to benefit from the LoRa network of the company Orange deployed on Reunion Island and Mayotte in order to strengthen the reception network.

One of the expected objectives of the project was that the installation of the receiving station network could be easily implemented by non-specialists. This proved to be the case on Aldabra, where SIF agents were able to deploy several receiving stations in total autonomy after having received training and advice from Ifremer and LIRMM. A big congratulations!

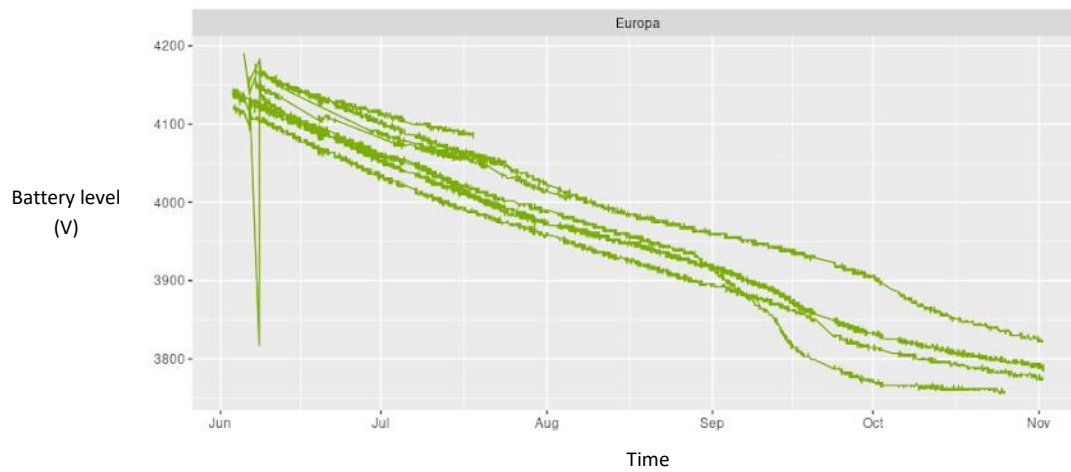
A total of **98,290 messages** were received by Ifremer scientists, with an average of 2,405 messages received per turtle at all sites. Each message contains data on the water temperature, the turtle's dive profile (depth, dive time, surface time) and information on the tag (battery level, for example) and on the receiving station that received the message. The information collected also provides information on the average duration of transmissions, ranging from 13 days (Reunion Island) to 100 days (Europa), as well as the maximum duration of transmission, which is **170 days** for a tag deployed on an Aldabra turtle.

Here are some examples of data recorded by IOT tags:

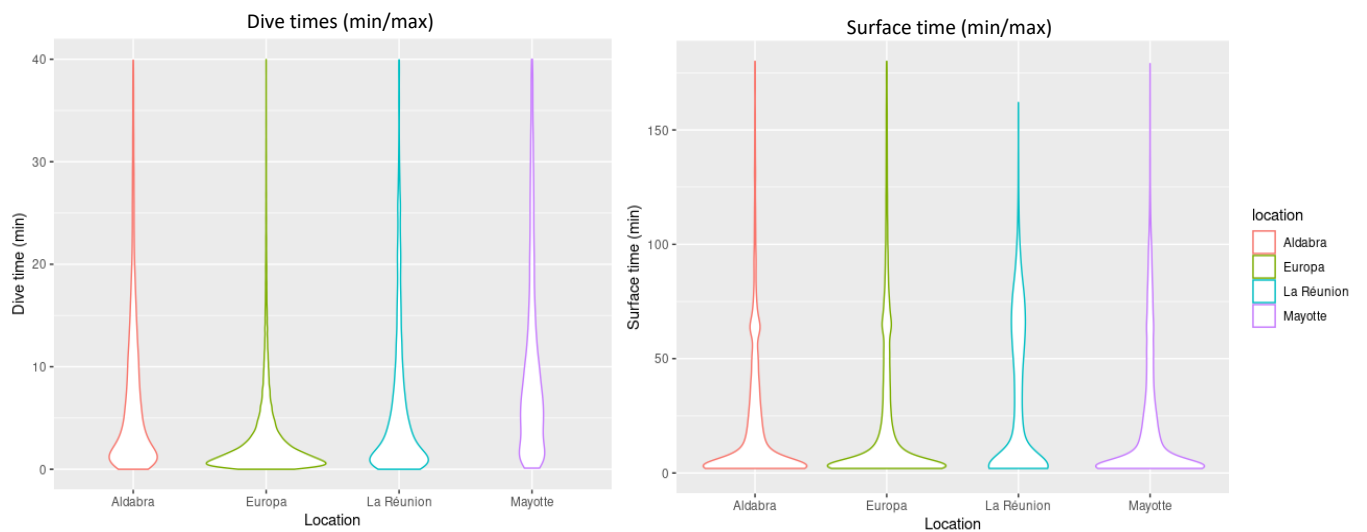
Temperature data recorded by IOT tags - example of Mayotte © Ifremer



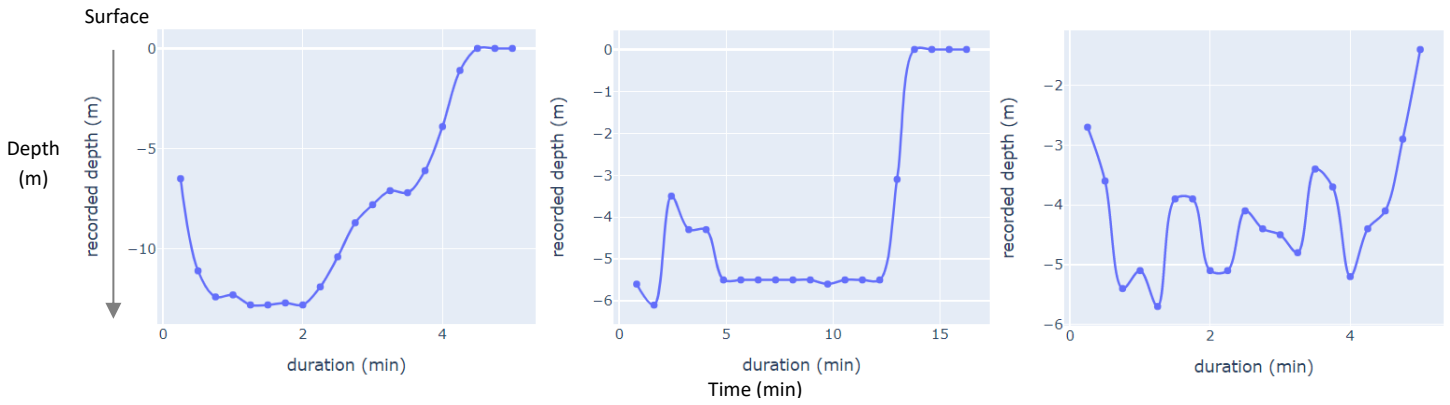
Battery level of IOT tags, Europa example © Ifremer



Dive times and surface times (minimum/maximum) transmitted by IOT tags © Ifremer



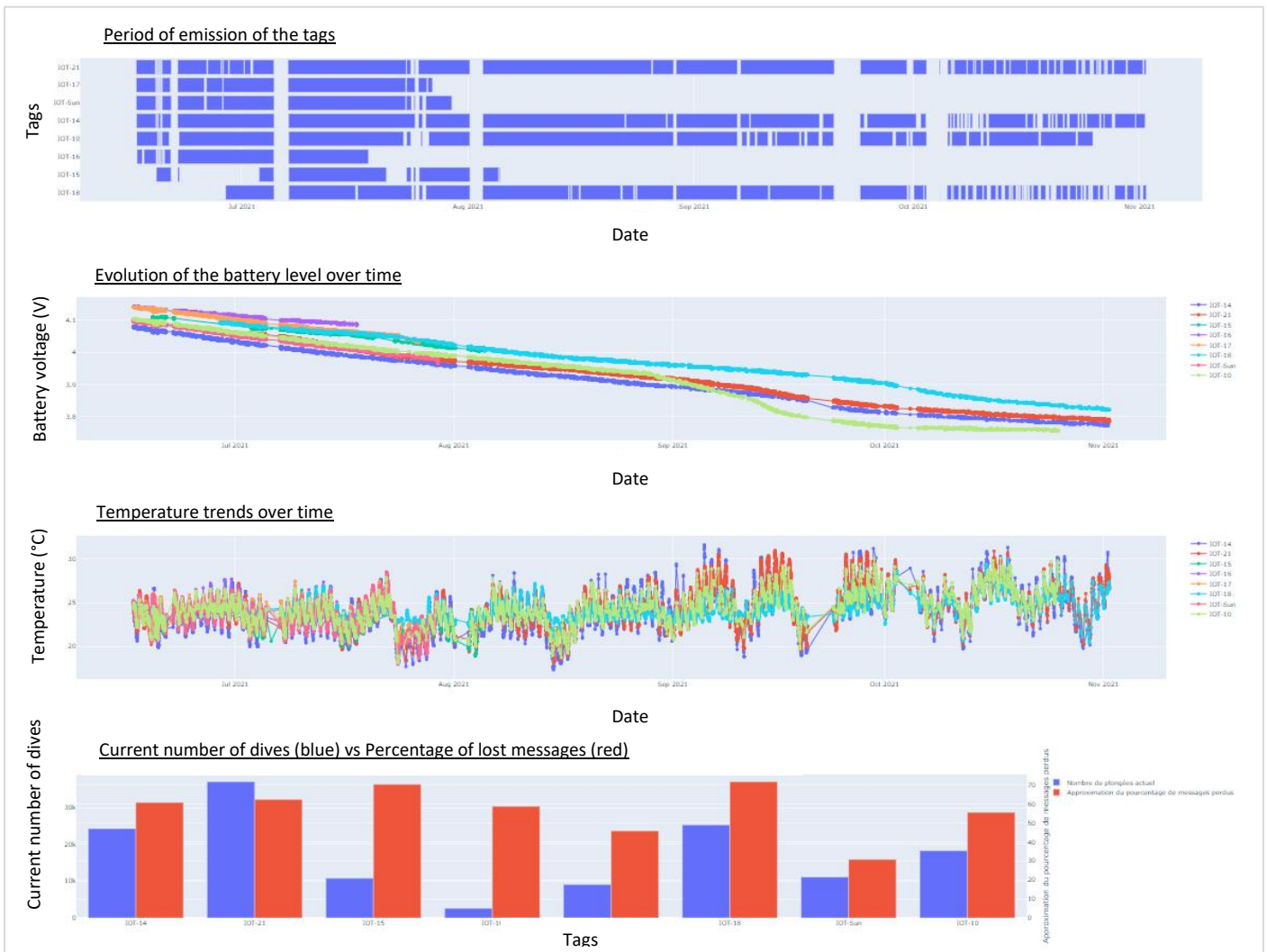
Example of a dive profile of a turtle from Reunion Island © Ifremer



VISUALIZATION TOOL

As part of his work-study programme (Master 2 in Computer Science) within the Indian Ocean delegation, Alexandre BOYER has developed a tool dedicated to the analysis and sharing of data collected by IOT tags. This online **visualisation tool**, initially intended for project partners and until the data can be published by the project team, allows for both secure online data storage and easy access for scientists.

Home interface of the IOT project data sharing and visualisation website © Ifremer



Example of information available on the IOT project data sharing and visualisation website © Ifremer

FINAL RESTITUTION

On Thursday 9 June 2022, the **final feedback meeting** of the IOT project was held at Ifremer's premises in Reunion Island by videoconference in the presence of all the project partners.

This final meeting provided an opportunity to review the major stages of the project at the end of three and a half years of development, testing and deployment of the new tags and the network of receiving stations on the four study sites across the south-western Indian Ocean (Reunion Island, Mayotte, Europa in the Scattered Islands and Aldabra atoll in the Seychelles). The partners were able to discuss the results and research prospects for the future, with the aim of improving these tags and applying them to other marine species.



Final restitution of the IOT project in Ifremer's premises in Reunion Island © Ifremer

COMMUNICATION



A Minute Of Science With...

#AMinuteOfScienceWith... are **short videos** made by Ifremer researchers through which they share with the public their work, a discovery, an anecdote or answer a scientific question that everyone is asking. Initiated during the containment, these videos are broadcast on social networks and the Institute's You-tube channel. You can find the one on the IOT project presented by Anne-Laure CLEMENT from the Indian Ocean delegation of Ifremer on <https://www.youtube.com/watch?v=32-zaz79BAo>



« Mon Lopin de Mer » project

"Mon Lopin de Mer" is an **educational project** that invites future citizens (4th and 5th grade and middle school) from all backgrounds, even those who are far from the coast, to forge an emotional link with the coast and the ocean, to make them aware of the fragility of these environments and our dependence on marine ecosystems, and to encourage them to become involved citizens.

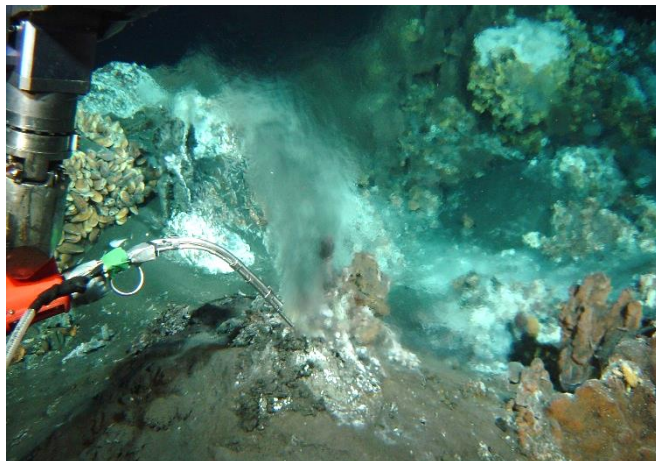
Supported by Ifremer and the Petits débrouillards, this project was tested for the very first time during the 2021-2022 school year with six classes across metropolitan France and the overseas territories. Mr Maillard's 5th grade class from **Plateau Goyave primary schools** in Saint-Louis was able to participate in this first edition of "Mon Lopin de Mer". Throughout the school year, they were able to discover and understand the vital link that unites us with the ocean, by building **their "little patch of sea"** with the help of a board game. They then identified the risks to their patch of sea, analysed the relationship between man and the sea and thought about solutions that could help preserve it using scientific reasoning.

The project also includes a meeting with a scientist and Anne-Laure from the Indian Ocean delegation of Ifremer came to present the **IOT project** and the delegation's missions to the pupils on 28 April 2022. During this session, the children were able to discover the different species of marine turtles present in the Indian Ocean, the threats they face and the technological tools developed by Ifremer and its partners to study them and track their movements.



Presentation of the IOT project to the pupils of the Plateau Goyave school in the framework of "Mon Lopin de Mer" © Betsy Viramoutou/Les Petits Débrouillards Réunion

The **final presentation** of the project was held on 20 June 2022 by videoconference in the presence of all the classes from Saint-Louis (Reunion Island), Nice, La Colle sur Loup (Nice academy), Nancy, Gan (Bordeaux academy) and Guerlesquin (Rennes academy), with the participation of Ifremer scientists who spoke in class and **live with the oceanographic vessel "Le Pourquoi Pas?"** which was at that time in the middle of the Atlantic Ocean, more precisely on the **"Lucky Strike" hydrothermal site** of the mid-Atlantic ridge, carrying out scientific surveys and submarine dives on the hydrothermal vents.



Victor 6000 robot working at a depth of 1,600 metres at the Lucky Strike hydrothermal site © Ifremer

Sea Day

As part of the **Ocean Festival** organised by the Western Tourist Office, Sciences Reunion, the Maritime Cluster of Reunion and the Marine Nature Reserve of Reunion Island, the Indian Ocean delegation of Ifremer took part in the **Sea Day** on 25 June 2022, during which all the professionals of the sea come to present their work to the public



Cancelled in 2020 and 2021 due to the health crisis, this event brought together many visitors who were curious to discover the jobs of scientists (researcher, engineer, technician, etc.) and to discuss the research topics of the Institute and the delegation.

The **IOT project** and all the projects carried out by the delegation were presented to the general public through discussions, games, videos, etc.



Animations on the Ifremer stand during the Sea Day (virtual reality helmets, videos, games for children) © Ifremer

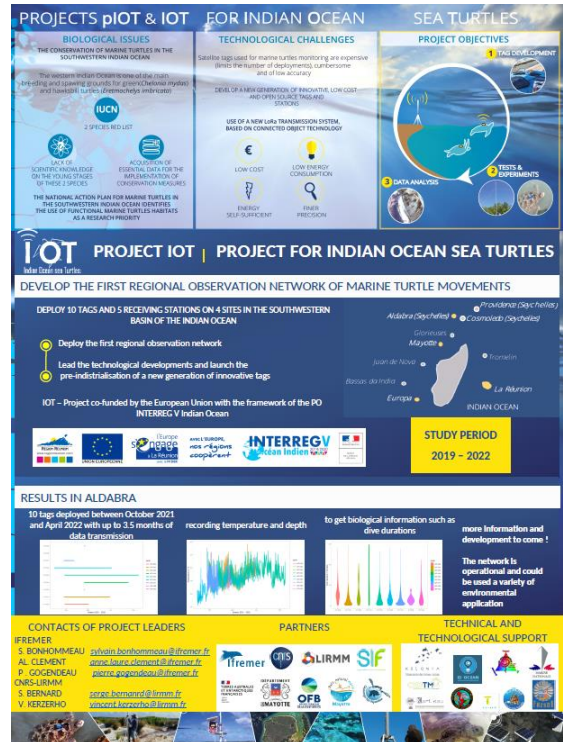


Scientific communication



On the occasion of the **Aldabra research station 50th anniversary symposium** held on 21 April 2022 at the Royal Society in London, the Indian Ocean delegation of Ifremer produced a **scientific poster** presenting the IOT project and the results obtained for the Aldabra site.

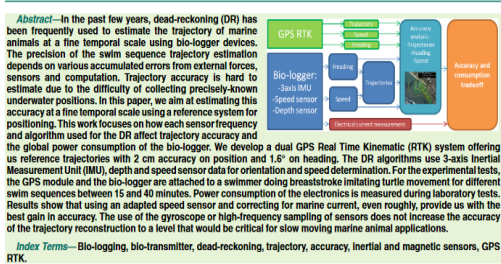
This poster can be consulted on the following link: <https://archimer.ifremer.fr/doc/00773/88525/>



Poster of the IOT project presented at the “Aldabra research station 50th anniversary symposium”
© Ifremer

Dead-Reckoning Configurations Analysis for Marine Turtle Context in a Controlled Environment

Pierre Gogondeau¹, Sylvain Bonhommeau, Hassen Fourati², Denis De Oliveira, Virgil Taillandier, Andrea Goharzadeh, and Serge Bernard



As part of the thesis work carried out by Pierre Gogondeau of Ifremer, a **scientific article** was published in the **IEEE Xplore** (Institute of Electrical and Electronics Engineers) journal entitled "Dead-Reckoning Configurations Analysis for Marine Turtle Context in a Controlled Environment".

The paper can be found at : <https://ieeexplore.ieee.org/document/9763044?source=authoralert>

Pierre Gogondeau's doctoral thesis defence will take place in November 2022. If you wish to follow it by videoconference, please send an email to the delegation delegation.reunion@ifremer.fr to receive the connection link



FINAL CLAP

Three and a half years ago, with European co-financing from the European Regional Development Fund (ERDF INTERREG V Indian Ocean 2014-2020), the Indian Ocean delegation of Ifremer launched the ambitious "**Indian Ocean Sea Turtles**" (IOT) project with the aim of developing new, innovative, smaller, energy-efficient, low-cost and open source tags adapted to juvenile sea turtles and creating the first sea turtle observation network in the south-western Indian Ocean basin through regional scientific cooperation.

This **regional cooperation** has mobilised players from the world of research, such as the Montpellier Laboratory of Computer Science, Robotics and Microelectronics (LIRMM) attached to the CNRS and various Ifremer laboratories, as well as organisations responsible for the management and conservation of the study sites, these include the Seychelles Islands Foundation (SIF), the French Southern and Antarctic Lands (TAAF), the Mayotte Departmental Council, the Mayotte Marine Natural Park, the Reunion Island Marine Nature Reserve, as well as other collaborations that have developed over the years (Oulanga Na Nymba, Maritime Gendarmerie of Mayotte, Le Jardin maoré, FAZSOI).

Despite some setbacks that occurred with the Covid health crisis in the middle of the project, such as the supply of electronic components or the planning of deployment missions to the study sites, the project's objectives were **fully achieved** thanks to the support of all the partners and teams.

The Indian Ocean delegation of Ifremer would like **to thank** all the people who, through their support, their involvement and their work, have made this beautiful project possible and successful.

The IOT project is ending but the work continues with the **IOT 2** project in perspective!



... IOT 2

On the strength of the results obtained with the IOT project, Ifremer and its partners wish to **continue the work** by developing even more efficient tags in order to **extend the transmission of tags by satellite** to **new species** (fish, marine mammals) as well as to **adult** marine turtles, which would make it possible to improve our knowledge of reproduction and migration while continuing the work on juvenile turtles, where there is still much to learn.



© KINEIS-CLS



© Ifremer



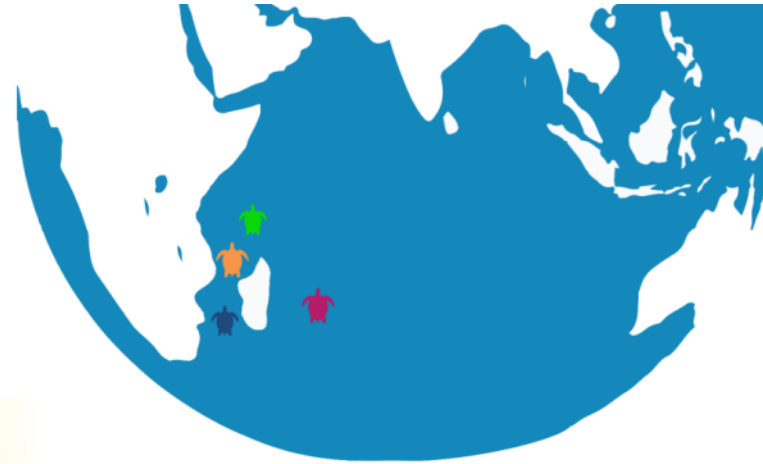
© Matthieu Juncker



© Ocean Obs

To stay informed, visit the website of the Indian Ocean delegation of Ifremer

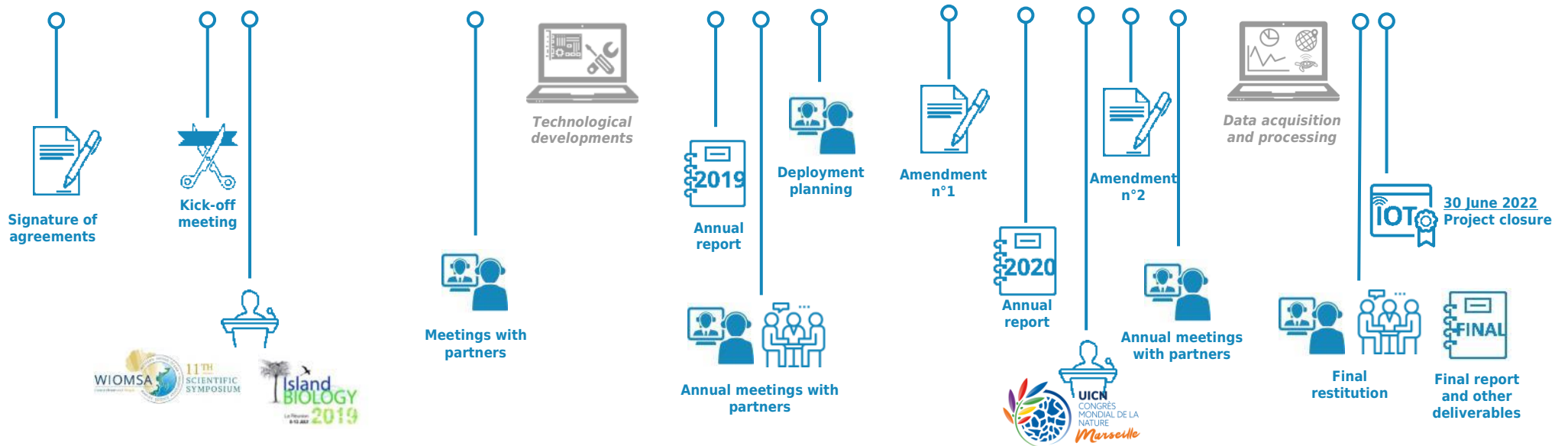
<https://ocean-indien.ifremer.fr/en>



Test and deployment sites and periods:

- Reunion Island:**
 - ■ ■ tests
 - deployment
- Mayotte Island:**
 - ● ● prospection
 - deployment
- Scattered Islands (TAAF):**
 - deployment
- Aldabra Island (Seychelles):**
 - deployment

PROGRAMMING AND PROGRESS





To know more about it, visit the web site :

<https://ocean-indien.ifremer.fr/en/Projects/Technological-innovations/piOT-2018-2020-IOT-2018-2021>

CONTACTS OF PROJECT LEADERS		SCIENTIFIC AND TECHNOLOGICAL CONTACTS	
IFREMER		LIRMM	
S.BONHOMMEAU	sylvain.bonhommeau@ifremer.fr	S. BERNARD	serge.bernard@lirmm.fr
A.L. CLEMENT	anne.laure.clement@ifremer.fr	V. KERZERHO	vincent.kerzerho@lirmm.fr
P. GOGENDEAU	pierre.gogendeau@ifremer.fr		

FUNDS			
PARTNERS		TECHNICAL AND TECHNOLOGICAL SUPPORT	