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SOUTH AMERICA

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COLLECTE LOCALISATION SATELLITES

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SOUTH AMERICA

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EDITORIAL

By Christian Bull
CEO of Cunlogan S.A and CLS Representative in Chile

An emerging continent, South America is not only home to our reservoir of biodiversity and the lungs of the planet, but also to nations undergoing rapid economic development.

This race for development and industrialisation is impacting the natural environment. In its Living Planet Report 2010: Biodiversity, Biocapacity and Development, the World Wildlife Fund (WWF) indicates that since the 1970s, the population of South American and Caribbean species have dropped by 55%, a loss related to generalised changes in land use and growing industrialisation. The forest is receding to make way for livestock grazing lands. Intensive farming of transgenic soybeans also leads to deforestation. If we add climate change, and the fact that the South of the continent lies below the Antarctic ozone hole, the list of threats is unprecedented.

Aware of the likely consequences, South American scientists are sounding the alarm.

How can we track species and weather conditions in environments as extreme as the Atacama Desert, the mountainous regions of the Andes, the Argentinean pampas or the Amazon jungle? How can we protect migratory species in such vast and hostile areas?

The answer for biologists and hydrologists lies in satellite technology. The information satellites provide is crucial. They are the only way to obtain a global, constantly-renewed picture of the impact of human activities on biodiversity and the environment. Satellite data can support researchers' theories. The Argos satellite system is a valuable tool for the South American scientific community. We rely on it both for our day-to-day research and biodiversity conservation projects and to raise awareness among the general population and companies of the adverse effects their activities are having on the environment.

All ARGOS publications are available at:
www.argos-system.org

MAPPING THE HOME RANGE OF HARPY EAGLES IN THE BRAZILIAN AMAZON BASIN

By : Francisca Helena Aguiar-Silva, Tânia M. Sanaiotti / INPA

The Harpy Eagle (*Harpia harpyja*),

commonly known as the "gavião-real" in the Brazilian Amazon, is the most powerful bird of prey from Americas.

Originally, its range extended from the lowland tropical forests of Southern Mexico and Central America to those of South America, where it was very widespread, until the unprecedented reduction of forests in these regions, unprecedented for 500 years.

The population of the species that is sparsely distributed and generally rare throughout its extensive range has now fallen to just a very few couples in several of these regions and is assumed to be extinct in others. Overall, the Harpy Eagle is considered by the IUCN (International Union for Conservation of Nature) as a "near threatened" species because of the population decline owing to hunting and habitat loss.

Currently its only refuge is in South America, and especially in the Amazon rain forest, the largest refuge for the maintenance of their populations.

Habitat use by Harpy Eagle and its feeding ecology

Way of life and threats

The Harpy Eagle is a species of raptor that lives in tall forests and breeding above the canopy of the forest. Pairs re produce only one chick once every three years. There are an obvious cost/benefit issues surrounding the conservation of this species.

The Harpy Eagle nests at the very top of trees and hunts within the canopy layer of the forest, its prey being mostly tree-living mammals, including several species of sloth (*Bradypus spp. and Choloepus spp.*), monkeys (*e.g. Cebus spp. and Alouatta spp.*) and also porcupines (*Coendou spp.*). It also consumes birds and reptiles, but to a lesser extent.

The Harpy therefore clearly needs these tall trees in which to reproduce, but the need to protect forest flora and fauna comes into conflict with human interests. The species is seriously threatened, throughout its original range, as the wood of the tree species it uses has great commercial value.

The key issues

Which are the regions where Harpy Eagles breed and hunt? Which factors created by human beings modify the structure of the forest and affect the habitat and movements of Harpies?

Scientists must find answers to these questions to enable them to come up with effective strategies and action-plans for the management of forest resources and the preservation of this magnificent species in the Amazon rain forest.

The methods used

To gather this information, we rely on GIS technologies to help track the individual birds, which are fitted with transmitters coupled with a GPS device.

In Brazil, data obtained via equipments fitted to birds released into the wild have already provided information about the resources exploited by this species.

The government takes note of the problem

As a result of the studies carried out, government policy-makers have decided on regional strategies for the protection of nature, mainly as regards forest management and establishing the boundaries of protected areas.

Understanding the behavior of the species by studying its use of natural resources

In 2012, Helena Aguiar-Silva began her doctoral studies with the idea of installing radio-transmitters on adult Harpies that were currently raising young: the Harpy Eagle pairs feed their offspring for almost two years. By using the ARGOS system it would be possible to learn exactly where they were and how they moved around the Amazon rain forest while hunting, eventually providing information about their living space during this period.

The Harpy Eagles are captured in the forest in their nests and fitted with satellite transmitters coupled with altitude and velocity sensors, attached to them as a sort of backpack.

At a later stage, the information about their movements and the sectors of the forest they frequent will be correlated with variables about the structure of the forest and the

prey with which they feed the chick in the nest. All these correlations will provide data as to the relative wealth and abundance of the available sources of food for breeding Harpy Eagles.

Cooperation between researchers and managers

Last year was the first time that the Brazilian Harpy Eagle Conservation Program (PCGR – visit http://gaviaoreal.inpa.gov.br) used the ARGOS system, on a sub-adult Harpy.

The bird first underwent a rehabilitation process carried out with support from the Brazilian Institute for the Environment and Renewable Natural Resources (IBAMA – visit www.ibama.gov.br), the Chico Mendes Institute for Biodiversity Preservation (ICMBio – visit www.icmbio.gov.br) and the Brazilian authorities for the regulation and control of the use of environmental resources, before being released into the wild and tracked for a year.

Weighing during tagging of a Harpy Eagle juvenile. By F.H. Aguiar-Silva and O. Jaudoin

The results obtained

According to the initial analyses, this individual, not yet an adult and not part of a pair, moves through the forest in its search for prey; it covers 6.7 km/month, uses an area of 111 km²/year and returns to certain areas in different months but without establishing a definite territory (Fig.1).

The mapping also shows that this individual stays close to the edge of the forest, which suggests that this corresponds to its hunting territory; as the sloth, its principal prey, lives in the canopy at the edge of the forest.

In 2013 and 2014, other specimens of the same species will be fitted with ARGOS transmitters; wild breeding individuals and injured individuals which, once restored to health and rehabilitated, will be potential subjects for reintroduction into the wild.

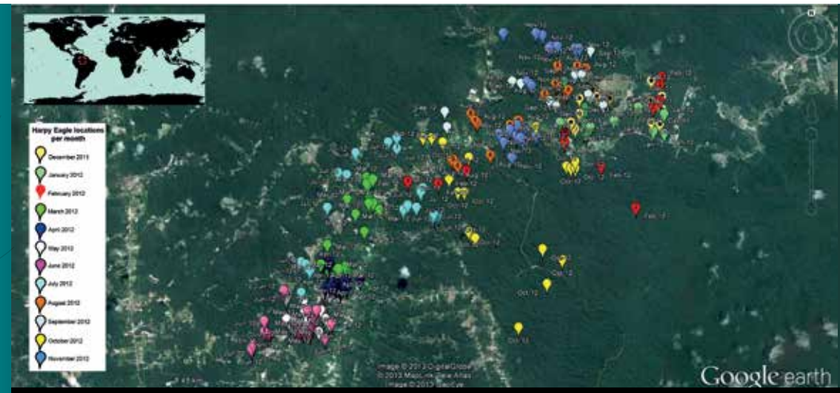


Fig. 1: Harpy Eagles' locations in the Brazilian Amazon basin between December 2011 and November 2012

Action at national level

The PCGR carries out research into the ecology of the Harpy Eagle, the Crested Eagle (*Morphnus guianensis*) and the Ornate Hawk-eagle (*Spizaetus ornatus*).

It encourages the rehabilitation of specimens and their reintroduction into the wild and carries out awareness-raising and environmental education in the Brazilian States where these species are known to nest.

Francisca Helena Aguiar-Silva

Helena Aguiar-Silva is a doctoral student in ecology at the National Institute for Amazonian Research (INPA), Manaus, Brazil. Since 2005 she has been working on the feeding ecology of the Harpy Eagle and carries out awareness-raising and environmental education for the conservation of Harpy Eagle and of other large raptors and on protection of the natural environment. She also co-leads the Preservation of the Brazilian Harpy Eagle Conservation Program (PCGR).

Tânia M. Sanaiotti

Tânia M. Sanaiotti is a researcher at the National Institute of Amazonian Research (INPA), Manaus, Brazil. She has carried out post-doctoral work on the potential nesting area of the Harpy Eagle at the National Institute for Space Research (INPE), São Paulo, Brazil. She is the coordinator for the Program for the Preservation of the Brazilian Harpy Eagle (PCGR) and, in parallel with her research on the Harpy, she also studies the ecology of the birds, reptiles and plants of the Brazilian savanna.

SPATIAL ECOLOGY: TRACKING VICUÑAS IN THE CHILEAN ALTIPLANO

By Benito A. González, and co-authors Denise S. Donoso, Rodrigo Villalobos, Nicolás Lagos, Agustín Iriarte / IUCN

The vicuña

is one of four species making up the South American camelid family and lives wild in the central Andes of Peru, Bolivia, Chile and Argentina at an altitude of 3,600 to 4,500 metres. Vicuñas are the main large herbivores in the region, weighing some 45 to 50 kg for a shoulder height of 90 cm.

This vast region–characterized by strong sunlight, wide temperature ranges and summer rains–hosts two sub-species: *Vicugna vicugna mensalis* in the North, and *Vicugna vicugna vicugna* in the South.

Both sub-species can be found in Chile: the first in the Arica and Parinacota Region (17.5° S) and in part of the Tarapacá Region (20°S), and the second as far as the Atacama Region (28.6°S).

Regulations to protect this species

The species was hunted indiscriminately for its extremely fine wool until the 1960s, leading to a dramatic drop in the population. This resulted in the adoption of an international agreement on its protection in 1979, the "Convention for the Conservation and Management of the Vicuña".

This international effort enabled vicuña population numbers to increase such that the species is now classified in the «Least concern» category by the IUCN worldwide. Locally, however, the situation is variable, with both large herds and small or low-density populations. In the Atacama Region, the southern vicuña is classified as an endangered species.

It can be found in protected areas in the Lacustre Laguna del Negro Francisco and Laguna Santa Rosa Complex, protected by the RAMSAR convention. Between 2010 and 2012, the environmental consulting company Flora y Fauna Chile Ltda. studied the spatial ecology of vicuña populations in the Andes Mountains in the Atacama Region in order to analyse the species' living space, movements, use and selection of habitats.

Vicuña tracking using the ARGOS satellite system

For this study, five adult vicuña (two males and three females) were captured using anaesthetic darts (medetomidine/ketamine). The animals were then fitted with Telonics collars (model TAW-4210) equipped with Argos satellite position-finding technology. The collars were programmed to transmit one signal per week. Data analysis was based on class 3, 2, and 1 locations (Hays et al. 2001), with a total of 173 locations between March 2011 and January 2013.

Main results

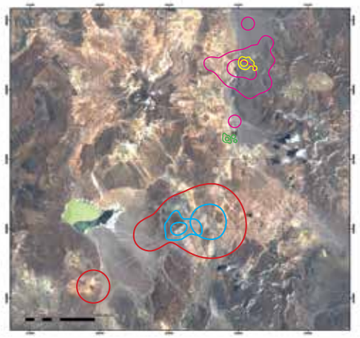
Data analysis showed that in general, the individual habitat covers between 22.1 km² and 43.5 km², with an area of intensive occupancy of 2.6 km².

Moreover, the tracked vicuña remained within a specific geographical area, moving on average 0.94 km per week in no specific direction. Overlap between the living areas during and outside the breeding period was 31.6%, providing evidence that vicuña are sedentary animals able to withstand this extreme environment and to survive locally without migrating.

Satellite data also determined the tracked animals' use and preferences in terms of habitat. It revealed that they preferred habitats within a limited distance (<500 m) of plains and marshes, and reject those much further away (>1000 m). They also preferred low-slope areas (<5°) and avoided medium-slope (between 5° and 20°) and high-slope areas (>20°).

These results supplement previous studies and highlight the importance of protecting these ecosystems and giving priority to low environmental impact management in these areas.

Habitat of vicuña tracked by Argos
The inner circles correspond to the highest occupancy zone, and the outer circle to the entire habitat.



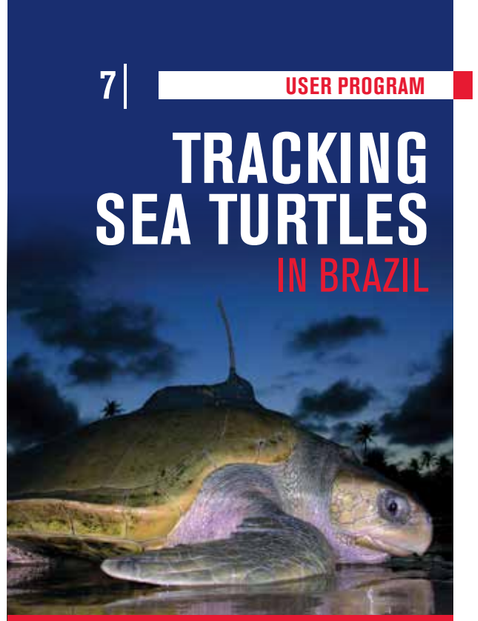
Rose: vicuña # 57286 Blue: vicuña # 57288 Red: vicuña # 57298
Yellow: vicuña # 57287 Green: vicuña # 57296

Benito A. González

Benito A. González is a PhD in Forestry, Agricultural and Veterinary Sciences in Chile, researcher at the Universidad de Chile and member of the South American Camelids Specialist Group of the IUCN. His interest is focused on ecology, evolution, management and conservation of Andean and Patagonian ungulates with emphasis in spacial ecology, genetic and phenotypic variations of the Guanaco and Vicuña.

Denise S. Donoso, Rodrigo Villalobos, Nicolás Lagos and Agustín Iriarte are researchers in Flora & Fauna Ltda, a Chilean environmental consultancy firm.

TRACKING SEA TURTLES IN BRAZIL



By Alexsandro Santos, Maria Angela Marcovaldi, Gustave Lopez, Jaqueline de Castilhos, Milagros lopez Mendilaharsu / TAMAR-ICM

Sea turtles,

are highly migratory have a complex life cycle and use a wide range of habitats. All five turtle species found along the Brazilian coast are endangered and included in the National Brazilian Endangered Fauna Species List of the Ministry of the Environment, and in Appendix I to the CITES convention. These species include the loggerhead sea turtle (*Caretta caretta*), the hawksbill sea turtle (*Eretmochelys imbricata*), the olive ridley sea turtle (*Lepidochelys olivacea*), the leatherback sea turtle (*Dermochelys coriacea*) and the green sea turtle (*Chelonia mydas*).

In 1980, the Sea Turtle Conservation project–today known as the TAMAR-ICM Bio.

Threats

For many years, sea turtles were hunted for their eggs and meat. Exploitation for consumption is now regulated, but new threats have emerged and even increased, such as coastal development, intensified fishing, pollution, diseases and climate change. Protective measures were applied to breeding sites, but a number of uncertainties still remained, specifically concerning the feeding grounds of female turtles.

Argos satellite tracking and results

Argos satellite tracking (or "telemetry") has significantly improved our understanding of sea turtle behaviour. Adult females, for example, can migrate thousands of kilometres between breeding sites and feeding grounds. Satellite tracking is used to map migratory routes and identify foraging and high-use areas. Along the northern coast of the State of Bahia, 15 satellite transmitters were fitted to hawksbill sea turtles (*E. imbricata*) and 10 to loggerhead sea turtles (*C. caretta*) during the nesting season on the region's beaches. After the inter-nesting period, all females migrated to distant feeding grounds up to 2000 kilometres away from the beaches.

Results

Study results revealed important aspects of the habitat use and identified a migratory corridor along the north-eastern coast of Brazil. Main foraging areas of loggerheads turtles were located along the northern coast of Brazil, especially off the coast of Ceará (Fig 1).

A few hawksbill sea turtles migrated northwards and remained in feeding grounds between the States of Rio Grande do Norte and Pará, like the loggerhead sea turtles, while others moved toward coral reef areas along the coast of Alagoas and southern Bahia (Fig 2).

In the State of Sergipe, 10 female olive ridley sea turtles (*L. olivacea*) were fitted with Argos satellite transmitters.

During the breeding season the females remained along the coast of Sergipe, area that overlaps with the area of operation of the shrimp trawl fleet, a major threat to this population.

After laying their eggs, most of them migrated along the continental shelf towards feeding grounds along the northern, north-eastern and south-eastern coasts of Brazil, while two females migrated to ocean waters near the equator (Fig. 3).

Finally, four female leatherback sea turtles (*D. coriacea*) were tracked by satellite. Three were tagged on nesting beaches in Espírito Santo State and one incidentally capture in a drift-net off the coast of São Paulo State. Tracking in the breeding area revealed that between successive egg-laying trips, the turtles spread out and move up to 160 km off the coastline. The post-nesting migrations helped to identify feeding grounds between the South of Brazil and the Rio de la Plata estuary (Fig 4).

The overlap between the high-use areas of these animals and large-scale fishing zones was highlights a major threat to these turtles.

Conservation implications

Tracking data helped us understand some of the movements and high-use areas of sea turtles in Brazil. These findings were used to organise certain human activities such as fishing, and to improve coastal management.

A factor of great importance is that the breeding and foraging grounds of most turtles tracked are located within Brazilian territorial waters. This provides a good starting point to ensure the long term protection of this important portion of sea turtle's life cycle, as many political and national conservation measures are already established.

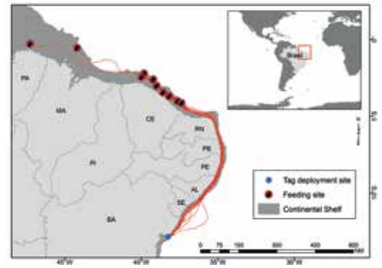


Fig. 1: Post nesting migration and feeding grounds of 10 female *C. caretta* turtles satellite-tracked from nesting beaches along the northern coast of Bahia State, Brazil.

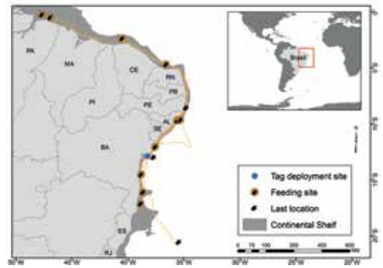


Fig.2: Post nesting migration and feeding grounds of 15 female *E. imbricata* turtles satellite-tracked from nesting beaches along the northern coast of Bahia State, Brazil.

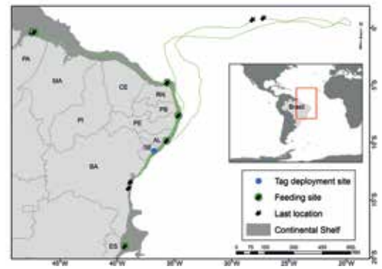


Fig. 3: Post nesting migration and feeding grounds of 10 female *L. olivacea* turtles satellite- tracked from nesting beaches in Sergipe State, Brazil.

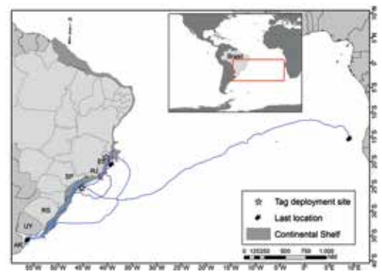


Fig. 4: Migration routes and high-use areas of two leatherback sea turtles tracked from nesting beaches in Espírito Santo (blue line), and a female incidentally in a drift-net off the São Paulo coast, Brazil (purple line).

PROJETO TAMAR 33 ANOS

Our 5 authors are actively involved in the TAMAR-ICM project, created to identify the main breeding sites of sea turtles in Brazil and threats to their survival.
Learn more on: www.argos-system.org

DEEPEN HYDROLOGY KNOWLEDGE IN FRENCH GUYANA

By Pierre Timmerman et Erwan Escouplier / DEAL

French Guyana

is in South America, in the eastern part of the Guyana Plateau. It merges into the Amazon Basin and as a result of the high rainfall 99% of this area of 80,000 km2 is covered by equatorial rain forest. The drainage pattern is consequently very extensive and human activity is mostly found along the rivers.
The DEAL (Directorate for the Environment, Land Planning and Housing) is responsible for maintaining and developing the hydrometric network installed on the main rivers of French Guyana; this is a network of instruments that regularly and constantly sends back data about water levels and flow rates. The primary purpose of this information is to improve knowledge of the hydrology of each catchment area, but it is also used to help forecast high and low water levels in areas of importance to humans.

Hydrometric network

ORSTOM (formerly IRD) started installing hydrometric instruments at stations along the rivers of French Guyana in the early 1950s. Water levels were first observed by reading water measurement gauges, but the techniques were improved later with water levels being recorded first mechanically and then digitally. In its heyday, the network consisted of 20 operational field stations covering the entire region, but from the end of the 1990s the network was gradually abandoned due to a lack of human resources.

The DEAL took over the running of the hydrometric network in 2003, since when it has been working on ways of resizing and perfecting it. Today it consists of seven fully automated stations, on five of the major rivers.

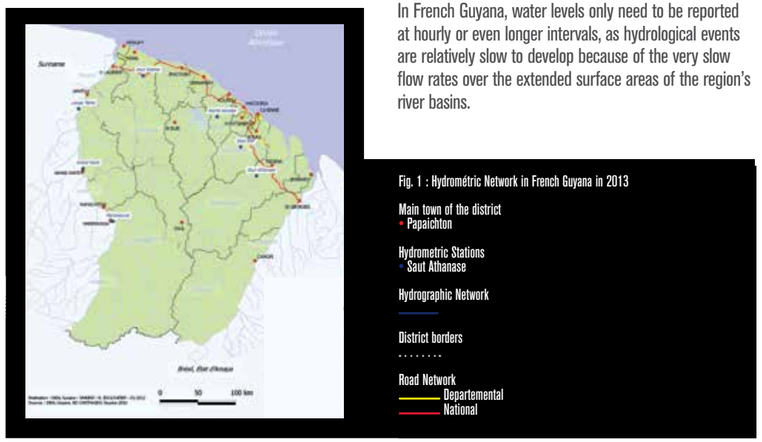


Fig. 1 : Hydrométric Network in French Guyana in 2013

Amazonian features

The environment of the Amazon rain forest means that it can be very difficult to get to the sites where the stations are located, some of which are relatively far away from any inhabited area and accessible only by pirogue (river canoe).

The climate is particularly challenging for technologies involving electronic components, and the abundant natural vegetation prevents the use of data transmission by GSM or radio.

Faced with these constraints and the impossibility of carrying out frequent field missions to retrieve data and perform station maintenance, the DEAL decided to acquire robust stations, with long-term power autonomy and capable of relaying the data acquired via satellites.

In French Guyana, water levels only need to be reported at hourly or even longer intervals, as hydrological events are relatively slow to develop because of the very slow flow rates over the extended surface areas of the region's river basins.

Hydro-ARGOS stations

The Hydro-ARGOS hydrometry instruments used by the DEAL were specially designed by NKE Instrumentation , which has experience producing water-proof, resistant, autonomous oceanography beacons, using the ARGOS satellite system for data relay.

These instruments are fitted with a piezoresistive probe, placed on the river bed, which measures the pressure of the water column that is then converted into a water level. Water levels are acquired every 20 minutes and the data are recorded in an internal memory and transmitted to the satellites of the ARGOS system.

To make up for the absence of coverage by ARGOS satellites moving in orbit within reach of a given transmitter, and for the limited size of ARGOS messages, which can only contain the last 12 water level measurements acquired (i.e. a four-hour period), it was decided that stations should transmit strings of 4 messages every 2 minutes, each containing 12 measurements. Each complete string therefore contains 16 hours of data. In each new data string, the oldest value is replaced by the most recent value.

The messages transmitted are then validated by the ARGOS centres and the water-level data are made available just a few hours after their acquisition, on a web site giving access to the DEAL database in Cayenne.

Partnerships

The DEAL's objectives (of extending knowledge of the hydrological dynamics of the catchment areas of French Guyana and forecasting high and low water events) are shared by several stakeholders involved in research and risk assessment.

In particular, the DEAL is currently working with the French weather forecasting institute, Météo France, to set up a hydro-meteorology watch unit. The DEAL's hydrometric data are also of considerable value for land development and research into climate change or the application of space techniques to the study of surface waters.

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Oceanographic buoy NKE

Pierre Timmerman

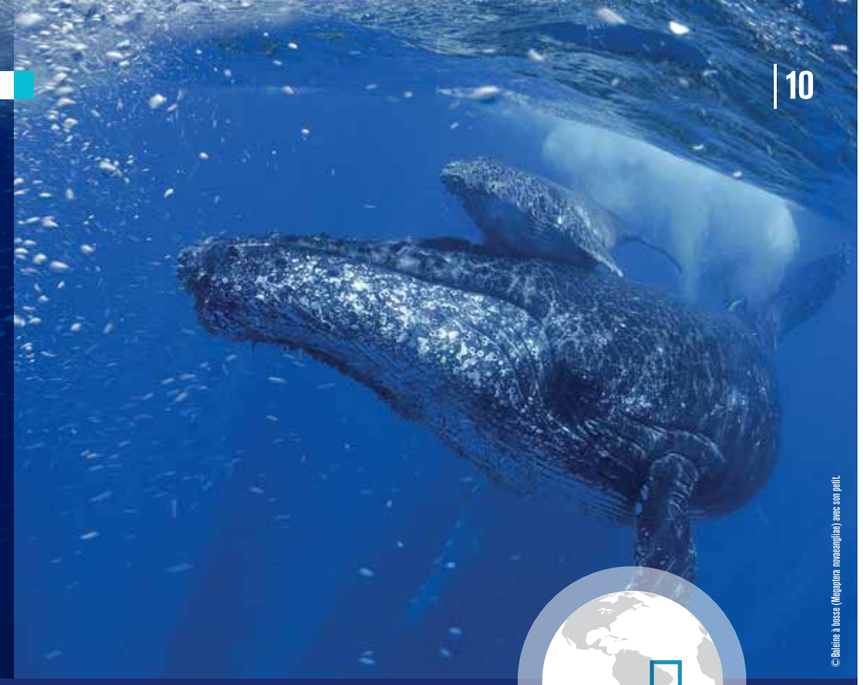
Pierre Timmerman was recruited as a hydrology specialist by DEAL Guyana in 2009 and is involved in developing the hydrometric network and programmes for vigilance and forecasting of extreme hydrological events. He has considerable experience in managing flood risks, as well as in coordinating water-related projects and studies.

Erwan Escloupier

Erwan Escloupier has a Masters 2 research degree in hydrology and the environment, and joined DEAL Guyana's hydrometry-hydrology unit in 2012 to set up a hydro-meteorology watch unit covering the French Guyana catchment areas as well as to oversee the technical deployment of the hydrometric stations in the field.

UNVEILING THE MYSTERIES OF HUMPBACK WHALE MOVEMENTS AND MIGRATION

IN THE WESTERN SOUTH ATLANTIC OCEAN



© Beluine à bosse (Megaptera novaeangliae) avec son petit.

By Alexandre N. Zerbini, Artur Andriolo, Phillip J. Clapham, Daniel Danilewicz and Travis Horton / Aqualie Institut

Humpback whales (*Megaptera novaeangliae*, **Fig. 1**) **are highly migratory animals that move seasonally between low-latitude breeding habitats and high-latitude feeding grounds.In the western South Atlantic, nearly 10,000 humpback whales occur in shallow coastal waters off northeastern and central Brazil during the breeding season. Whales typically start to arrive in April/May, abundance peaks in August and September and by November most animals will have initiated their >4000 kilometer southward migration towards highly productive sub-Antarctic and Antarctic waters.**

A research project supported by Shell Brasil and led by Instituto Aqualie, a Brazilian non-profit organization, was initiated to understand movements and migration by remotely deploying ARGOS satellite transmitters on humpback whales in the western South Atlantic Ocean. The overall goal of this international collaborative study – which involves scientists from Australia, Brazil, Denmark, New Zealand, and the United States – is to improve conservation and management of humpback whales, and to contribute to the development of whale satellite tagging techniques.

As part of this projetc, nearly 120 Wildlife Computers SPOT5 implantable PTT tags (Fig. 1) were attached to humpbacks off Brazil. These tags have provided unprecedented information on movements and habitat use and remarkable insights into how humpbacks navigate in the South Atlantic Ocean.

Discovery of Migratory Routes and Destinations

The migratory routes and destinations of Brazilian humpback whales remained unknown for more than a century. This species was hunted beginning in the mid-1800s and by the mid-1900s they became very rare in their wintering grounds. In 1983, scientists started to collect individual identification data (photographs and biopsy samples) from a recovering population visiting the coast of Brazil.

However, a comparison of these data with those from certain high-latitude feeding grounds (for example, the Antarctic Peninsula) was unable to establish the migratory trajectories of the Brazilian whales. Only when Argos satellite tags deployed in the Brazilian whales, in 2003, that the migratory routes were revealed.

ARGOS satellite tags deployed showed for the first time that animals wintering off western South America migrate through offshore routes towards remote areas in the southern South Atlantic, near South Georgia and the South

Fig 1: Humpback whale equipped with an ARGOS tag (PTT Wildlife Computers SPOT5).

Sandwich Archipelago (Fig. 3).

This corresponds to one of the regions with the greatest abundance of krill (*Euphausia superba*) in the Southern Ocean.

These results were somewhat surprising because they indicated whales are currently using habitats in which they had not been regularly seen before. Humpback whales were heavily exploited by whaling off South Georgia where nearly 23,000 individuals were killed between 1904 and 1914.

Almost all these whales were captured within 100 miles from shore to the north-northwest of the island. In contrast, the great majority of the whales tracked with satellite tags moved far offshore to areas located 300 to 700 nautical miles to the east-northeast of South Georgia, suggesting that distribution relative to the early 1900s have changed.

This shift in distribution is not yet completely understood and may have been caused by loss of the cultural memory of near shore foraging habitats due to severe population depletion, competition with other krill predators, environmental changes, or a combination of these factors.

Conservation Implications

Understanding the breeding ground movement patterns, migratory routes and destinations has also been important to improving conservation and management of humpback whales in the South Atlantic. Current anthropogenic threats to these whales include ship strikes, incidental catches in fishing activities, and habitat degradation associated with coastal and offshore development.

Satellite telemetry has proven to be an effective tool for long-term monitoring and for improving conservation of whales. For example, results of Instituto Aqualie's project have shown that marine protected areas require new boundaries if they are expected to shelter the humpback whale's breeding habitat off Brazil. Further conservation-oriented efforts are expected in the near future because research is ongoing to

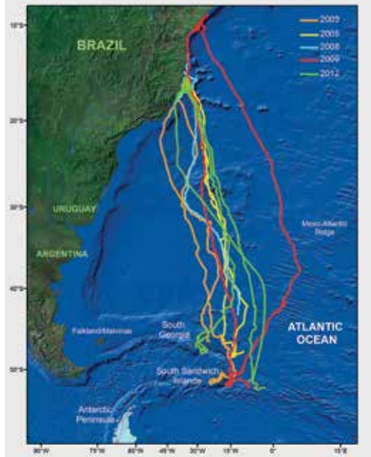


Fig. 2: Migratory Routes and Destinations of humpback whales in 2003, 2005, 2008, 2009 and 2012.

assess movements and habitat use of these whales relative to shipping lanes, fishing grounds, and areas of interest to the oil and gas industry.

Insights into Whale Navigation

In addition to documenting when and where humpback whales are located, ARGOS satellite tracking research provided new information on the navigation capabilities of these seasonal migrants. Perhaps one of the most revealing insights derived from this research is the demonstration that humpback whales cross spatially restricted migratory corridors in a series of remarkably constant course movements. A similarly surprising result of long-term tracking in the South Atlantic is the observation that many whales followed near identical routes across >3000 kilometers of open ocean despite being tagged in different calendar years. Such remarkable knowledge can only be gained through deployment and monitoring of high-quality tracking technologies.

Further application of tracking data remains to be fully explored to better understand animal orientation during migration. For example, by integrating spatially and temporally precise animal location data with geophysical tools (such as the recently developed Enhanced Magnetic Model) hypothetical systems of animal navigation can be tested and refined based on observed movements in natural environments. Tracking research has revealed several unexpected and remarkable insights into how humpbacks navigate, and further advances can be expected in the years ahead as tracking technologies are integrated with other cutting-edge environmental monitoring tools.

Instituto Aqualie

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Alexandre Zerbini is an expertin large whale satellite tagging and one of the coordinators of Instituto Aqualie's telemetry whale monitoring project. He currently holds a joint associate researcher position with the National Marine Mammal Laboratory of the Alaska Fisheries Science Center (NOAA Fisheries) and with Cascadia Research Collective, both in Washington State, USA.

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Phillip Clapham is an expert on humpback whales and whale conservation, and a collaborator on Instituto Aqualie's tagging project. He is currently the leader of the Cetacean Assessment and Ecology Program at the National Marine Mammal Laboratory in Seattle, WA, USA

Dr. Daniel Danilewicz

Daniel Danilewicz is the field operation manager of Instituto Aqualie's humpback whale tagging project. He is also a professor at the University

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Travis Horton is a Senior Lecturer of Geological Science at the University of Canterbury, New Zealand. Travis directs Canterbury's Stable Isotope Laboratory, and sits on the Fulbright New Zealand, Board of Directors.

NEW CONSERVATION TOOLS FOR SHARKS IN PATAGONIA

By Juan Martin Cuevas / CONDROS

In Argentina

while many species continue to show strong evidences of decline (e.g. tope shark *Galeorhinus galeus*, sand-tiger *Carcharias taurus*, copper *Carcharhinus brachyurus*, angel sharks *Squatina spp*. and some skates' species) non-evaluated management actions have been adopted to remediate these trends, despite the official implementation of the National Plan of Action for Sharks in 2009.

In 2011 Juan Martín Cuevas (Chondrichthyans Research Group, CONDROS) and Gustavo Chiaramonte (Argentine Museum of Natural Sciences "Bernardino Rivadavia") combined their conservation projects in a *National Shark Conservation Program*. This program integrates scientific research with conservation actions, involving key stakeholders (anglers) as active members of the tagging activities of the program.

At the same time, the scientific output is the recording of ecological data of threatened shark species such as habitat uses, vertical movements and regional migrations. Afterwards, we will create a GIS database as a new conservation tool to improve the local management and conservation of elasmobranches in the South West Atlantic.

The tope shark is a coastal transient species, critically endangered in the South West Atlantic. Tope sharks probably migrate from southern Brazil to northern Patagonia during spring comprising a single population across Argentina, Uruguay and Brazil.

Due to the large numbers of school sharks congregated during spring and summer in closed gulfs and bays of northern Patagonia these are considered the main nursery areas for the species (e.g. inshore embayments of Bahia San Blas).

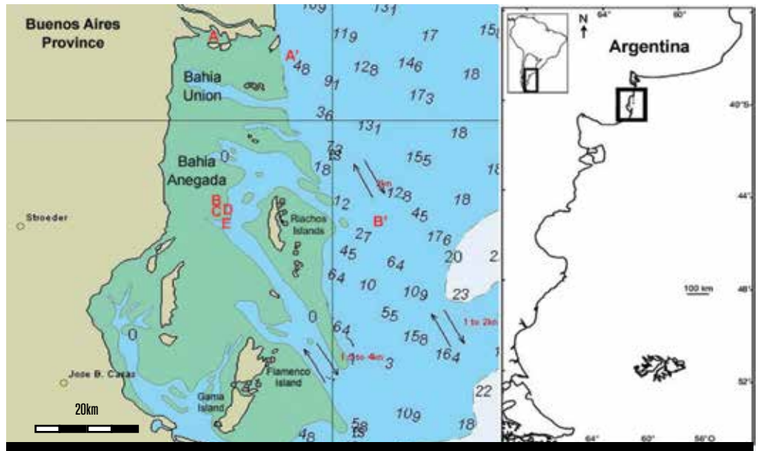

Fig. 1: Study area. Tagging sites for each tope shark: A, B, C, D and E. A', B' and C': Pop-off location of A, B and C PSATs.

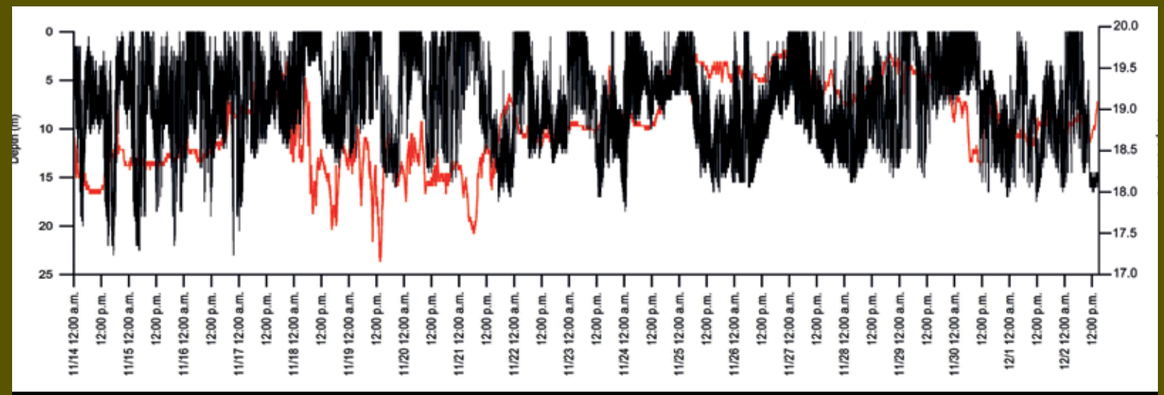

Fig. 2: Full archival depth and temperature record (red line) of the PSAT on a tope shark during the tracking period.

First PSAT tagging in Argentina

Tope shark individuals were captured, tagged using a MK10 satellite pop-up archival transmitting (PSAT) in Bahia Anegada (Natural Reserve of Bahia San Blas, Northern Patagonia). Three of them were tagged during November 2011 and two during November 2012 with the logistic support of local sportive anglers. Each individual was captured with sportive fishing gear, identified, measured for total length, sexed and tagged.

Three PSAT tags were inserted intramuscularly with a dart and two tags were secured at the base of the first dorsal fin with a plastic cattle identification tag. Data collection frequency was set to every 5 seconds with tags programmed to record water temperature, depth and light level binned into 6 hours histograms for 180 and 210 days. The automatic release feature was enabled with tags regarding depth variations ±3 m for 48 hours as constant depth. Igor Pro Version 6.2 (WaveMetrics, Inc.) and the Data Analysis Program 3.0 (Wildlife Computers) were used to analyze shark swimming data. Vertical movements were examined by plotting the depth and temperature readings for sharks against time of day and constructing a depth and temperature profile for each tracking period.

Depth behavior of tope sharks

Five females of tope shark from 120 to 140 cm total length were captured, tagged and released. The first three tags detached prematurely between 8 and 21 days and two of them were physically recovered, full archival datasets from 696 hours were downloaded with a total tracked period of 40 days.

The other two tags are still collecting data. The largest distance travelled from the deployment position was 51.2 km and all sharks tagged offs were inside the reserve. Tope sharks demonstrated a narrow vertical distribution, inhabiting depths from the surface to a maximum of 24.5 m, but without a clear diel vertical pattern.

The most common dive trend observed was vertical oscillatory movements. Sharks spent most of the time during day (80%) and night (83%) at depths shallower than 10 meters and the rest of the time between 10 and 20 m. Tope sharks used to swim mainly in waters within temperature between 17°C and 19°C, and in a minor percentage in temperatures between 19°C and 21°C.

Maximum vertical speeds and dive heights were recorded at night and overall ascents movements were higher than descents.

Thanks to these various tools, it is now possible to better manage and preserve elasmobranches in the South West of the Atlantic Ocean.

Juan Martín Cuevas

Juan Martín studied in Marine Ecology with emphasis in conservation of coastal environments in Argentina. After his Master in Brazil focused on the biology and ecology of a sea urchin species as a potential fishing resource, to elaborate a management strategy before its commercial exploitation. As part of his Master he participated in different conservation projects in tropical marine ecosystems. Today he is working in CONDROS to do his Ph. D. on the Behaviour of Patagonian Chondrichthyans with a scholarship of the Universidad Nacional de La Matanza. He also co-leads the National Shark Conservation Program supported by: the Small Rufford Grants Foundation, the Mohamed bin Zayed Species Conservation Fund and the Conservation Leadership Program.

CONDROS Grupo de Estudio de Peces Cartilaginosos
The Rufford Small Grants Foundation www.ruffordsmallgrants.org
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GOLIATH GROUPER BIO-ECOLOGY
IN FRENCH GUYANA


©Rachel Berzins


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By Céline Artero / ONCFS

Céline Artero

Céline Artero is a French marine ecologist, involved for 9 years in various research projects for the conservation of endangered species such as sea turtles in Mayotte or whale sharks in Australia. Céline is currently working in French Guyana for the National office of hunting and wildlife (ONCFS), where she is completing her PhD on the biology and ecology of the Goliath Grouper.

The bio-ecology

of the Goliath Grouper is being studied in the turbid waters of French Guyana to increase our knowledge of this poorly-understood species, deemed to be critically endangered around the world. Since Céline arrived in May 2010, the ONCFS has been pursuing this project together with several partners: the nature reserve on the island of Grand Connétable, French Guyana's only marine reserve, managed jointly by the Study Group for the Protection of Birds in French Guyana (GEPOG) and the ONCFS; IFREMER; Florida State University; the University of the Antilles and French Guyana; and the Association for Recreational and Commercial Fishing in French Guyana (APPG). The project is entirely funded by the French Guyana Directorate for the Environment, Land Planning and Housing (DEAL).

The Goliath Grouper (*Epinephelus itajara*) lives in the tropical Atlantic. Sometimes exceeding 2.50 m in length and 400 kg in weight, it is one of the world's largest fish. It can live to a considerable age, grows slowly and reaches sexual maturity only at the age of 5 to 7 years. These characteristics and its calm and curious nature render it vulnerable to overfishing and underwater spear-fishing. In the 1950s, Goliath Grouper numbers declined to the point of it disappearing completely from part of its range (the coast of Africa and the Caribbean). Since 1996, the species has been listed as critically endangered on the Red List of the International Union for Conservation of Nature (IUCN) and fishing of the species has been progressively banned in almost the whole of its range (Florida, the Gulf of Mexico, the Caribbean, Brazil, etc.), except for French Guyana.

The waters off French Guyana are exceptionally turbid because of the sediment brought down by the Amazon. Nothing is known about the state of the population of Goliath Groupers in the waters of French Guyana, as there have been no studies of the ecology of marine fish in the region.

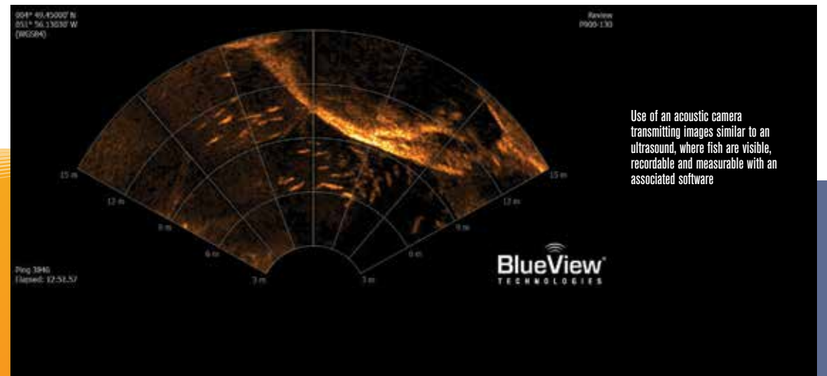
The "Grouper Project" is studying their growth, their reproduction, their feeding habits and the state of the population. Because of the vulnerability of this species, non-lethal methods have been developed. In 3 years, 376 individuals have been captured, tagged and released. Their ages were determined by counting the stripes on their dorsal spines which can be extracted without affecting the fish's survival.

The diet was studied by analyzing the contents of the stomach, sampled on living animals either by regurgitation (for small individuals < 120 cm) or by extraction directly from the stomach (for large individuals > 120 cm).

A new counting method was tested to overcome the difficulty caused by water turbidity: the use of an acoustic camera that transmits a video image similar to an ultrasound that renders the fish visible, countable and measurable, with the help of the associated software.

One of the major themes of the research was to study the reproductive habits of Goliath Groupers. These fish come together to breed, forming aggregations of up to a hundred individuals, making them even more vulnerable. To protect the species it is essential to identify the breeding sites and the season when they aggregate. In French Guyana, despite three years of research, no breeding among Goliath Groupers has been observed. Data from pop-up satellite archival transmitting (PSAT) tags will be used

Out of the three tags fitted to date, two have never transmitted any data and one became detached and floated back to the surface prematurely. The tags are being reprogrammed to optimize the technique in the hope of finally revealing just where the Goliath Groupers of French Guyana go to breed!



Use of an acoustic camera transmitting images similar to an ultrasound, where fish are visible, recordable and measurable with an associated software


© ISRO

SARAL launch from the spatial center Satish Dhawan in South of India.


© EUMETSAT

METOP B launch from Baïkonour in Kazakhstan

NEWS

TWO NEW SATELLITE LAUNCHES SARAL AND METOP-B

2012 - 2013 HAS BEEN SUCCESSFUL FOR THE ARGOS CONSTELLATION.

SUCCESSFUL LAUNCH OF SARAL

On February 25, 2013, on board the PSLV (Polar Satellite Launch Vehicle) Indian rocket, the SARAL satellite, equipped with ARGOS-3, was successfully launched into orbit.

Starting also April 29, 2013, the instrument onboard the SARAL satellite from ISRO has been providing the ARGOS-3 service on the orbital plan of 18:00.

NOAA-17 was decommissioned on April 10, 2013. This decommissioning is transparent to the ARGOS users because SARAL was launched on

February 25, 2013 on nearly the same orbit and is providing excellent performance.

METOP-B LAUNCH

On September 17, 2012, METOP-B, the second European satellite on a polar orbit was successfully launched with an ARGOS- 3 payload.

The 1792nd Soyouz Russian rocket launched METOP-B; the primary mission is meteorological.

Starting on April 29, 2013, the Data Collection and Localisation Service for low data rate was put into Service on Metop-B (ARGOS2- like service).

In addition, CNES has decided in coordination with EUMETSAT, and on the basis of compared performance, that Metop-A will be used for the ARGOS-3 service on the orbital plan of 21:30.

For the attention of biologists

For transmitters with power > 500 mW, the performance of METOP-B is equal to that of the other satellites. Regarding those transmitter with lower power, it is important to note that there is less gain on METOP-B in comparison to the other satellites.

Consequently, in order to maximize results it is strongly recommended to use the Kalman location services.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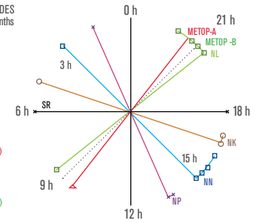
LOCAL TIME OF ASCENDING NODES
With Drifting effect at 6,12,24 months
April 2013



NK(LTAN=16:43:54) (d=0,72°/month)
METOP-A(LTAN=21:30:22) (d=0°/month)
NL(LTAN=20:30:57) (d=3,47/month)
NN(LTAN=14:57:58) (d=2,98°/month)
NP(LTAN=13:33:48) (d=0,35°/month)
METOP-B(LTAN=21:30:00) (d=0°/month)
SARAL(LTAN=6:00:00) (d=0°/month)

With two ARGOS-3 instruments in orbit in 2013, the operational services implementing the downlink will be provided for many years.

This new stage in the ARGOS System building is accompanied on the ground by the development of an ARGOS chipset, which will offer easy access to these services in the near future, for a large number of users.

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We know your work is interesting.
Let us publish it!
We are currently accepting contributions.
Articles (maximum 700 words) should be submitted in French or English.

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