GALAPAGOS REPORT 2013-2014

MARINE MANAGEMENT

MARINE WILDLIFE HEALTH SURVEILLANCE IN THE GALAPAGOS ISLANDS: FIRST YEAR RESULTS OF THE RAPID RESPONSE NETWORK

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The **Galapagos National Park Directorate** has its headquarters in Puerto Ayora, Santa Cruz Island, Galapagos and is the Ecuadorian governmental institution responsible for the administration and management of the protected areas of Galapagos.

The **Governing Council of Galapagos** has its headquarters in Puerto Baquerizo Moreno, San Cristóbal Island, and is the Ecuadorian governmental institution responsible for planning and the administration of the province.

The **Charles Darwin Foundation**, an international non-profit organization registered in Belgium, operates the Charles Darwin Research Station in Puerto Ayora, Santa Cruz Island, Galapagos.

Galapagos Conservancy, based in Fairfax, Virginia USA, is the only US non-profit organization focused exclusively on the long-term protection of the Galapagos Archipelago.

Marine wildlife health surveillance in the Galapagos Islands: First year results of the Rapid Response Network

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Introduction

Marine wildlife, especially marine mammals, act as sentinels of ocean and human health, providing early essential information regarding threats and impacts to marine ecosystems, which enables the establishment of preventive conservation strategies (Bossart, 2006).

Galapagos is home to a unique natural environment but various factors resulting from an ever-increasing expansion of human activities are threatening the health of many iconic species. Concerns within the marine environment include increased pollution, maritime traffic, the importation of goods from the continent, the impacts of introduced species, overfishing on some commercial species, and changes in ecosystem structure and resource availability due to climate change (Álava *et al.*, 2009 & 2011). Previous health research in Galapagos wildlife has focused on detecting diseases in avian and sea lions populations, and on anthropogenic impacts on sea turtles and birds (Salazar, 2006; Salazar *et al.*, 2007; Deem *et al.*, 2008; Zárate, 2009; Jiménez-Uzcátegui, 2010; Parra *et al.*, 2010). However, these programs had a limited duration due to lack of funding.

Until 2013, despite many isolated reports of injured animals that were handled by the Galapagos National Park Directorate (GNPD), there was no formal emergency network in place to rapidly detect and respond to sick, injured, or dead marine wildlife in the Galapagos Marine Reserve (GMR), nor was there a systematic program for health and disease monitoring and treatment. Many animals that came ashore were simply left or buried on the beach. Data collection was often inconsistent and little effort was made to determine the cause of death and the health status of the populations.

In 2012, the first Marine Wildlife Health Surveillance Program was initiated by the Charles Darwin Foundation (CDF) to implement a long-term health surveillance program and determine the most relevant threats to the iconic marine species of the GMR, such as sea lions, fur seals, sea turtles, sea birds, marine iguanas, and cetaceans. In 2013, a bi-institutional agreement between GNPD and CDF was established to develop effective methodology and organization for a Rapid Response Network (RRN), including standardized protocols, capacity building, and outreach (García-Parra, 2013), thus establishing the basic tool for a passive health surveillance program.

This program aims to respond to new cases and provide GNPD managers relevant information on wildlife health status and threats, to facilitate decision-making to ensure long-term conservation of marine biodiversity and environment. Results of the first year of the RRN operation are presented here.

Methods

Passive health surveillance

Passive surveillance involves collecting data and samples from injured, sick, or dead animals found onshore in order to identify pathologies and causes of death, which could be related to emergent, punctual, or mass mortalities due to natural or anthropogenic causes. In order to rapidly detect animals, the RRN operates a 24/7 emergency hotline, which activates a network of natural resource managers, park rangers, veterinarians, and local volunteers. Standardized action protocols were designed for both live and dead animals (Figure 1). When a live animal's injuries are caused by human activities, clinical veterinarian assistance is provided according to established ethical criteria appropriate to and developed with the GNPD. Complete necropsies are performed on dead animals if the carcass presents suitable conditions. Necropsy samples are preserved using three methods (10% formalin, RNA-later, and freezing at -20ºC) and then sent to specialized international laboratories to perform histopathological, microbiological, and toxicological analyses to determine the causes of death.
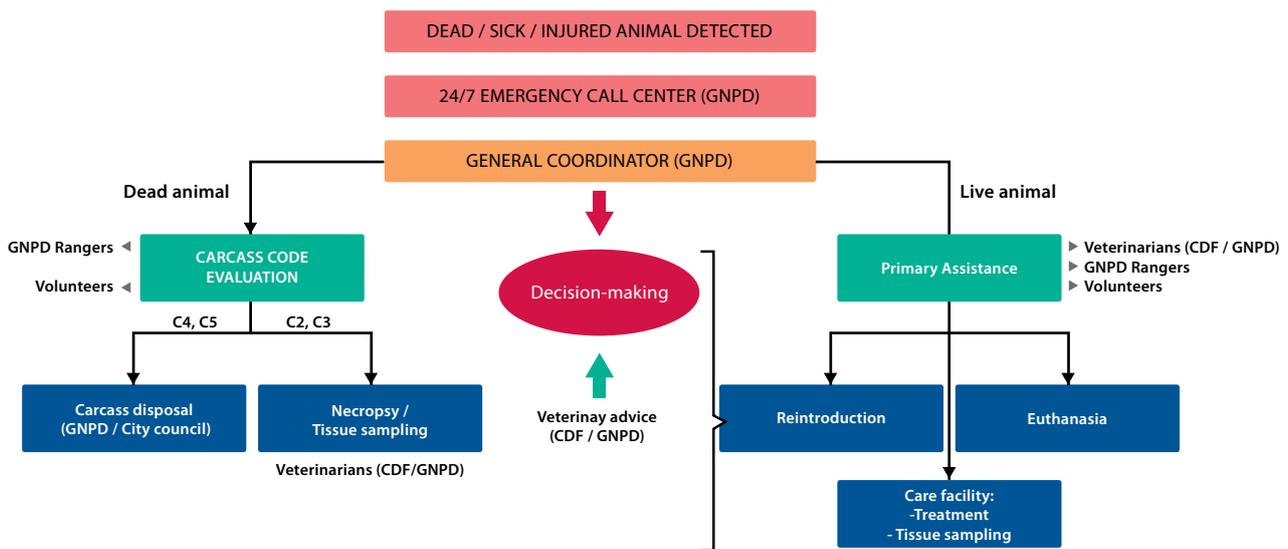

Figure 1. Diagram of the Rapid Response Network (RRN) operating system, © Carolina García, CDF 2013.

Training and outreach campaign

Two training workshops on "Rapid Response Network Operation and Protocols" were held in July-August 2013. Seventy-five park rangers participated and received training in RRN protocols, live marine wildlife handling and first aid, standardization of data collection, and identification of marine species. In order to increase the effectiveness of the RRN, 550 Galapagos naturalist guides were informed about the Wildlife Health Surveillance Program, the RRN project achievements, and preliminary data, as well as the role of naturalist guides as potential members of the network.

Results

During 2013, the RRN responded to 74 animals: 33 live animals and 41 dead animals. The live animals included 19 (58%) birds, 7 (21%) mammals, and 7 (21%) reptiles. The dead animals included 26 (63%) reptiles, 9 (22%) birds, and 6 (15%) marine mammals (Table 1). Although the health surveillance project was originally focused on marine wildlife, terrestrial wildlife was also assisted during 2013; the results are included here.

Of the 74 animals detected, 45 (61%) showed no indication of source of injury and thus were considered to be affected by unknown causes, 23 (31%) presented clear signs of anthropogenic impacts, and 6 (8%) were identified as natural causes. Human-related causes included: rodenticide intoxication (22%), dog attack (18%), car crash (17%), propeller impact (9%), and collision due to excessive glare (9%) (Figure 2). Marine iguanas (6 cases, 26%), sea birds (5 cases, 22%), and land birds (5 cases, 22%) were considered the most affected among species injured by human impact (Figure 3).

Fifty-eight of 74 RRN responses occurred on Santa Cruz Island, with a concentration of responses at Pelican Bay (Figure 4).

Unusual mortality event in marine iguanas

In early September 2013, Galapagos naturalist guides reported vomiting and deaths among marine iguanas at Tortuga Bay, Santa Cruz Island. The GNPD and the CDF, with support of the Biosecurity Control and Regulation Agency for Galapagos (ABG - Spanish acronym), conducted complete health assessments on 300 individuals. Between

September and December 2013, about 200 individuals were found dead: in Santa Cruz (~100), Española (16), and Floreana (82). CDF staff performed necropsies on 20 dead specimens, revealing oral ulcerations, compacted stomachs full of undigested red and green algae, severe esophagitis, gastritis, and enteritis.

Histopathological examination (performed by ZooPath) of 16 individuals confirmed severe necrotizing glossitis and esophagitis, mild interstitial pneumonia, acute congestion in the liver and spleen, and mild renal tubular necrosis in kidneys. Nine of the studied animals presented herpesvirus-like lesions, suggesting an infectious disease. Endotoxic shock was associated with death. Molecular analyses (performed by University of Florida) identified a novel herpesvirus but further research is needed to establish the clinical significance of the documented unusual mortality event. Results on the biotoxin determination are pending.

Table 1. Live and dead species detected by the RRN during 2013.

| Class	Species		Habitat		No. of Animals	
	Scientific name	Common name	Terrestrial	Marine	Dead	Live
Birds	*Asioflammeus galapagoensis*	Short-eared owl	X		0	1
	Buteo galapagoensis	Galapagos hawk	X		5	0
	Coccyzus melacoryphus	Dark-billed cuckoo	X		1	0
	Gallinula chloropus	Common gallinule	X		0	1
	Geospiza spp	Finches	X		0	1
	Leucophaeus fuliginosus	Lava gull		X	0	1
	Nyctanassa violacea pauper	Yellow-crowned night heron	X		0	3
	Pelecanus occidentalis urinator	Brown pelican		X	3	4
	Phaethon aethereus	Red-billed tropicbird		X	0	1
	Pterodrom aphaeopygia	Galapagos petrel		X	0	1
	Puffinus subalaris	Galapagos shearwater		X	0	6
Mammals	*Tursiops truncates*	Bottlenose dolphin		X	0	1
	Zalophus wollebaeki	Galapagos sea lion		X	6	6
Reptiles	*Amblyrhynchus cristatus*	Marine iguana		X	22	4
	Chelonia mydas	Green sea turtle		X	1	2
	Chelonoidis spp	Galapagos giant tortoise	X		1	0
	Conolophus subcristatus	Galapagos land iguana	X		2	1
Total					41	33
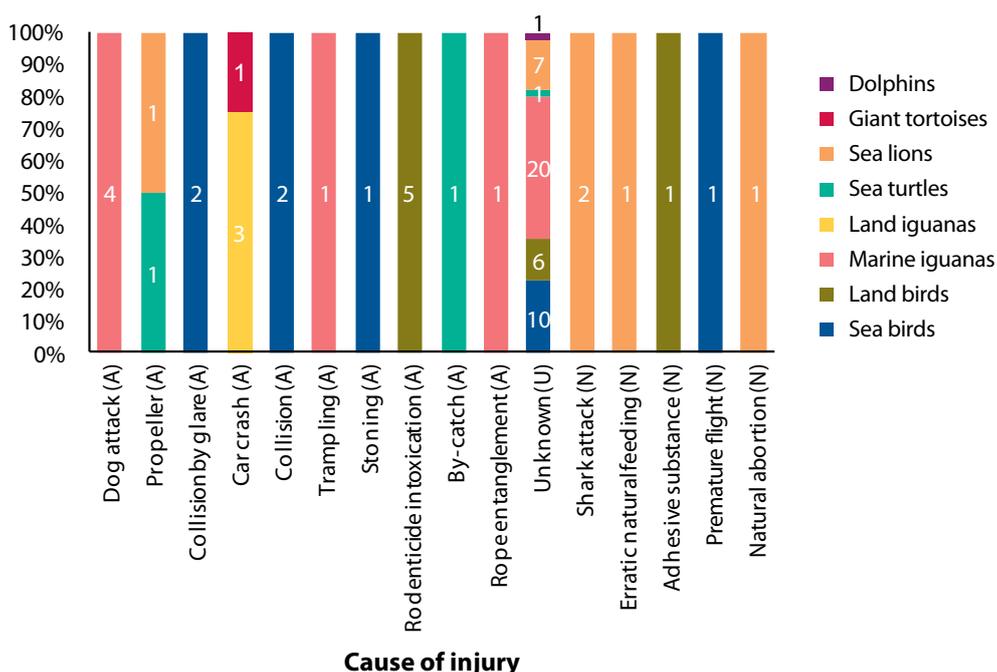
Figure 2. Causes of injury detected by the RRN in wildlife in 2013 (A= Anthopogenic; U= Unknown; N= Natural).
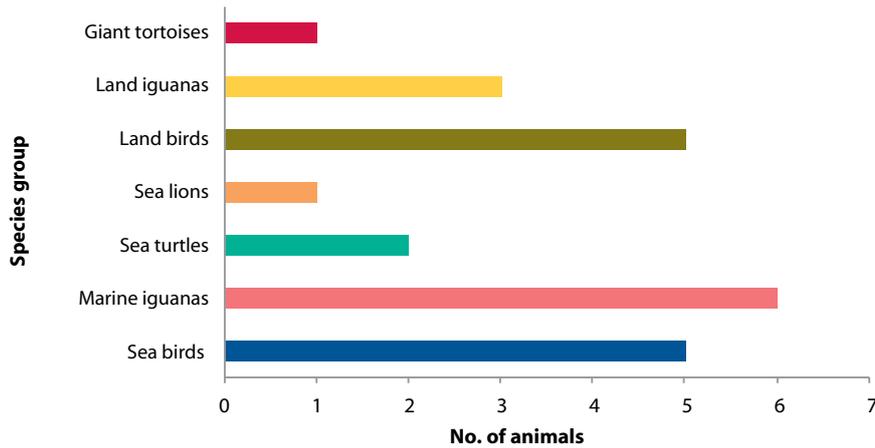
Figure 3. Number of animals injured or killed due to anthropogenic causes in 2013.

Recommendations

Nearly a third (31%) of the animals detected by the RRN was confirmed to be injured by anthropogenic effects. This should be considered a warning for conservation managers and stimulate an increase in mitigation strategies and efforts. According to 2013 results, management strategies should focus on:

Pelican Bay: Despite GNPD's ban, fishermen and tourists continue to feed wildlife. As a consequence, sea birds (especially pelicans) and sea lions frequent this site on a continual basis resulting in some being injured by fishermen in an effort to avoid fish stealing or by improper food items offered, such as tuna bones. There are also potential human health risks

(bites, zoonosis, etc.). Educational and informative campaigns should be implemented to raise awareness among fishermen and tourists to reduce human-wildlife contact at Pelican Bay. At the same time, the DNPG should increase its surveillance efforts.

Marine iguanas and dog attacks: Control of domestic dogs is essential for endemic species. Marine iguanas are especially vulnerable during the reproductive, nesting, and hatching seasons. Educational and pet training campaigns should be improved and coordinated among conservation management institutions.

Road traffic impacts on iguanas and birds: Traffic control and subsequent penalties should be
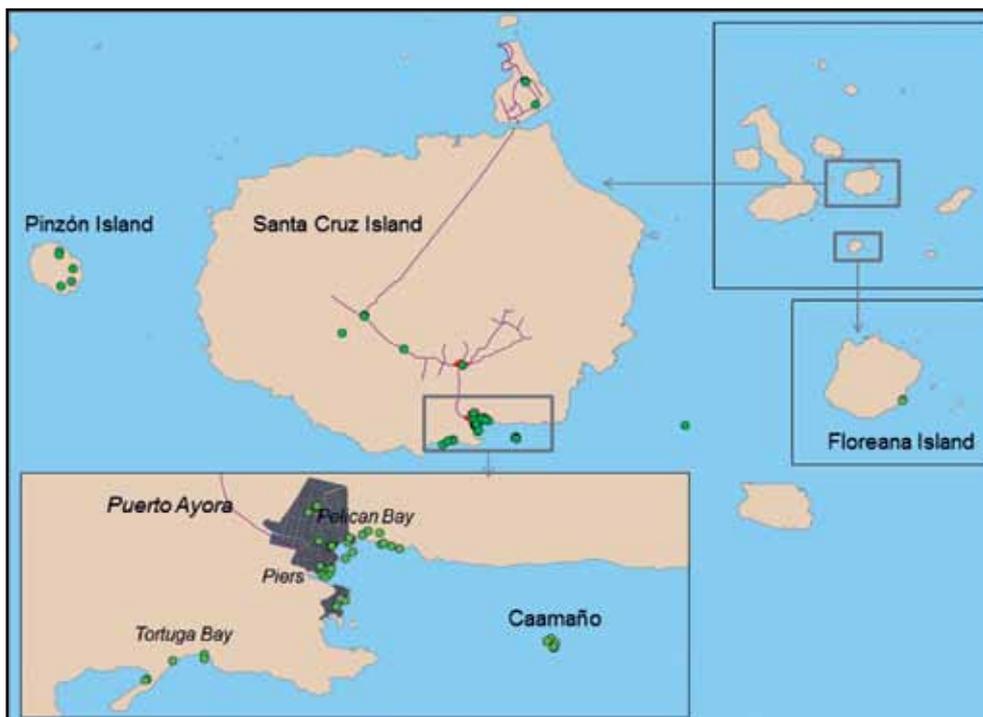

Figure 4. Distribution of animals detected by the RRN in 2013.

Photo: © Alan Kriegsfeld

increased on airport access roads and in urban areas to reduce wildlife injuries and deaths. Educational campaigns should parallel these efforts.

Boat strikes on sea lions and sea turtles: Boat traffic regulations should be improved and reinforced. Recommendations include reducing speed limits within three miles off the coast, improving control, and increasing educational and informational campaigns.

The Rapid Response Network is a useful tool for surveying wildlife health. However to ensure its long-term success, the GNPD must increase its capacity to oversee the program in perpetuity, maintain veterinarian service within the organization, and identify funds to support it. Suitable and equipped permanent facilities to assist live animals, perform necropsies, and laboratory routine analyzes are needed not only in Santa Cruz, but also in San Cristóbal and Isabela Islands.

Acknowledgements

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