ELASMOBRANCHII IN THE GALÁPAGOS MARINE RESERVE ARE STILL THREATEND

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SDG14 AND MARINE RESERVES

SDG 14.2 and **SDG 14.6** call for protection of **coastal** and **marine ecosystems**

The operation of marine reserves is **interconnected** to **several SDG‘s**

As a model reserve, the **Galápagos Marine Reserve** (GMR) provides the opportunity to demonstrate those, because of it‘s abundance of data

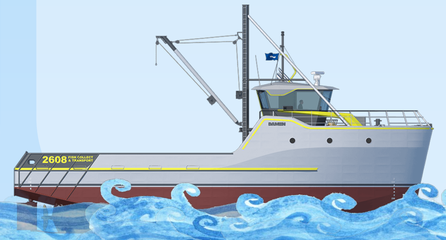
The GMR is a **success for increasing populations**, however it is currently **threatened by IUU fishing and tourism**

THE GALÁPAGOS MARIN RESERVE

The Galápagos Islands is located outside of Ecuador and was declared as **Marine Reserve in 1998**

The **GMR** is an ecosystem of **great biodiversity**, with Elasmobranchii as a key predator (1)

Furthermore **Elasmobranchii** can be used to explain the interconnections of SDG14 to other SDG‘s



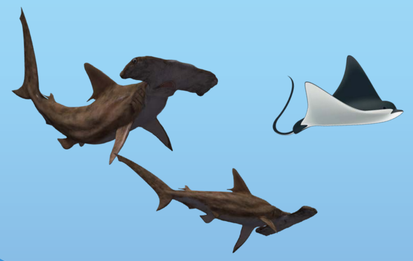
ELASMOBRANCHII AND IUU FISHING

50 species of **Elasmobranchii**, better known as **sharks and rays** live in the Galápagos Marine Reserve.

They are **very vulnerable** due to **slow growth** and **delayed maturation** (2)

Elasmobranchii have profited from the **Galápagos Marine Reserve** (3)

IUU fishing is still a concern, especially in relation to shark fins (4)



Around **80%** of the estimated **500.000 sharks caught** in Ecuador **originate from the Galápagos** (5)

IS TOURISM IS A THREAT TO THE GMR?

220.000 tourists visited Galápagos in 2015 (6)

65% of GDP comes from the **tourism sector** (7)

Tourism **increases pollution**, but **decreases IUU fishing** (8)

Improved legislation is needed **to undermine IUU fishing** and habitat disruption due to tourism **without challenging other SDG‘s**

Pictures taken from cleanpng.com

See accompanying article for full references
(1) Bustamante, R. et al., 2000 (2) Myers & Ottensmeyer, 2005 (3) Salinas-De-León et al., 2019 (4) Schiller et al., 2015 (5) Jaquet et al., 2008 (6) Izurieta, 2017 (7) Taylor, 2009 (8) Schiller, L., et al., 2015)

SCAN ME

Elasmobranchii in The Galápagos Marine Reserve are still threatened

Target 14.2 of Sustainable Development Goal 14 - Life below water (SDG 14) works towards "sustainably manage and protect marine and coastal ecosystems to avoid significant adverse impacts, including by strengthening their resilience, and take action for their restoration in order to achieve healthy and productive oceans" by 2020 (United Nations, 2018). One measure taken to accomplish this is the creation of marine reserve areas. According to the UN report on progress towards the Sustainable Development Goals from 2019, 17.2 percent of water under national jurisdiction is as of December 2018 covered by protective areas (The United Nations, 2019). The creation of marine reserve areas is a laborious task. A case study of a marine reserve area that significantly contributes to SDG 14 is located by The Galápagos Islands, which have been known for their unique ecosystems. The location of the island group creates the perfect conditions for marine life to flourish, making the Islands a symbol of rich biodiversity (Bustamante et al., 2000). Conservation efforts of the marine area surrounding Galápagos led to establishment of the Galápagos Marine Reserve (GMR) in 1986 (Jones, 2013). One related group of species that supposedly profits from the conservation efforts around Galápagos are the elasmobranchii, also known as sharks and rays (Hearn et al., 2014). In this paper, we aim to give a better understanding of how SDG14 and other SDGs relate to the work around the GMR, and how modern and future research can contribute to sustainable development of the GMR.

The Importance of Elasmobranchii

Elasmobranchii consists of about 1000 species, in which approximately 50 species live in the GMR (Hearn et al., 2014). They can be found in all marine habitats in the GMR, ranging from coastlines and mangroves to the deep sea, making the GMR a hotspot for sharks and rays (Hearn et al., 2014). From ecosystem perspective, sharks are apex predators in e.g coral reefs, and have the ability to structure food webs (Roff et al., 2016). For humans, biodiversity in coral reefs can contribute in feeding the population, for work and for the economy of the country. This can be linked to SDG 2 and 8, where the ambition is ending world hunger, and attributing work and economic growth respectively. But this group of species are found to be highly susceptible to overfishing and overexploitation by humans for several reasons, such as slow growth – and reproduction rate, delayed maturation and low egg production (Myers & Ottensmeyer, 2005). GMR is one of the few places in the world to have abundant populations of these top predators, and it's therefore important that they are protected properly (Acuña-Marrero et al., 2018).

Making The Galápagos Marine Reserve: Laws and Legislations

In an effort to protect the reserves and its inhabitants, several laws have been passed since 1986, when the Ecuadorian government defined the marine area surrounding the Galápagos Islands as a Marine Resource Reserve Area (Jones, 2013). Because the decree did not carry the status of a national protected area, making management and enforcement difficult, a ban on shark fishing and trading within the GMR was introduced in 1989. Additional concerns regarding sharks being caught within the borders of the GMR resulted in a new law passed in 1993 where all sharks were to be landed with fins intact (Carr et al., 2013). This law still enabled export and sale of "accidental catch", and caused exportation of huge quantities of shark fins from the mainland of Ecuador to the Asian market. The area was further defined as a Biological Reserve in 1996, and was granted the status as a national protected area in 1998. This status change improved collaboration between countries, and is therefore related to SDG 17 - Partnerships for the Goals, which focuses on revitalization of the global partnership for sustainable development (UN, 2015). The regulations of the Galápagos National Park were enforced, followed by a prohibition of commercial fishing. Shark fishing, landing and trading inside the GMR was not prohibited until 2003. Despite this, illegal fishing of sharks and finning continues to be a problem in the Galápagos Island National Park till this day (Carr et al., 2013). A controversial SDG can be identified, where the ban of commercial fishing goes against SDG 2. It will need an integration all stakeholders to decide whether other SDGs connected to SDG 14 will justify such measures in the future.

The Threat of the Rising Illegal, Unreported and Unregulated Shark Fishing

The management of sustainable fisheries in the Galápagos is extremely important to protect species from being overexploited and thereby its biodiversity in general (Cicin-Sain & Belfiore, 2005). One of the main concerns that have been increasing since the 1950´s is IUU shark fishing for shark fins (Schiller et al., 2015), which is also focused on in target 14.4; to effectively regulate harvesting and end overfishing, illegal, unreported and unregulated fishing and destructive fishing practices and implement science-based management plans. From more than half a million sharks caught per year in Ecuador, it is estimated that 80% originate from the Galápagos (Jacquet et al., 2008). As the sharks are caught, fishermen cut off the fins, and 70% of fishermen throw the remaining part of the still living shark into the water, where it slowly bleeds to death or chokes. Occasionally, the remains of the sharks are also sold for cheap meat or to make traditional medicine in Asia (Jacquet et al., 2008). The exploitation, harassment and shipping of the sharks is a problem related to SDG 12 - Responsible Consumption and Production. It appears to be difficult to end IUU fishing of sharks, as fishermen often state that their shark catch, which can be up to 70% of their total catch, was accidental, since the accidental catch of sharks is not punished (Jacquet et al., 2008). On the other hand, it is also thought that the local enforcement is mainly not strict enough (Carr et al., 2013). Targeting SDG 16, where the main focus is on peace, justice and strong Institutions, could potentially be needed here for the better.

Tourism on The Galápagos islands

Galápagos' main economy depends on tourism, and has grown extensively since the foundation of GMR (Mestanza et al., 2019). Starting with only 11 765 tourists in 1979 (Epler, 2007), the numbers kept rising and reached almost 224 745 by 2015 (Carlos Izurieta & Wukitsch, 2016). At a population of around 15 000 people, these numbers account for more than fourteen times the population. As a consequence of increased tourism, GMR has promoted productive employment by recruiting 40% of the island’s population since the seventies (Heslinga, 2003). Ecotourism in Galápagos, a form of tourism that tries to protect nature, have also shown to educate tourists and contribute to preservation (Heslinga, 2003). Therefore, tourism influences to a large extent SDG 8 and 4, in which SDG 4 focuses on quality education. Unfortunately, tourism on the Galápagos islands is not exclusively beneficial, as it is yet another threat to GMR (Mestanza et al., 2019). In an effort to reduce the rapid growth of tourism that threatens their ecosystems, Ecuador implemented a comprehensive legislation in 1988, which was a regime law responsible for the sustainable development of Galápagos (Heslinga, 2003). However, in later years, other issues to tourism have been found; it is estimated that a total carbon footprint of 532 373 tons of CO2-eq is produced, the biggest part resulting from international air-travel. But these results are not left unheard, and is said to be implemented in further management plans (Cordove-Vallejo et al., 2012), which can be seen as an urgent action to combat climate change, which is the goal for SDG 13.

Future research

The existing research covers important areas in the GMR, but there are aspects that could be improved, specifically on IUU fishing; increased knowledge on the abundance of illegal shark fishing through quantitative data could potentially give a better enforcement strategy to decrease IUU (Carr et al., 2013). When it comes to tourism, further research on its relation to declining fish stocks could also be performed. Another problem is bias, a common problem that can take place in all stages of research (Pannucci & Wilkins, 2010). Studies on the current research in GMR has shown tendencies to biased research; a study conducted by Edgar et al showed that densities of shark were five times higher in regions open to fishing and tourism compared to conservation regions. These results can be interpreted as a sign of biased selection of marine protected areas, in which conservation zones are placed in areas with interesting features by tourism operators (Edgar et al., 2004). Therefore, research on species in GMR can be dominated by potentially biased studies in the form that the researchers on the islands use results that solely support marine protected areas. In cases like this, future research of GMR´s effectiveness should continuously report effectiveness of the chosen enforcement, as well as working with scientists all over the world at all times.

In conclusion, much research has been done on the GMR, specifically regarding the subclass elasmobranchii. With all this research, several legislations have followed, and produced positive outcomes; protection from commercial fishing granted by the GMR has resulted in abundant sources of prey, which are predictable. Sharks, who are a key species for protection in the Galápagos, have predominantly been able to flourish with GMR and its protection policies, despite its difficulties with tourism (Salinas-De-León et al., 2019). Current research in GMR has also revealed the importance of SDG 14, and how working towards this goal contributes in partly achieving other SDG´s.

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