

Message From the Executive Director

This annual report gives us the opportunity to reflect on three full years completed on our ambitious Global Reef Expedition. We have now surveyed and mapped the coral reefs of eleven different countries, widely distributed from the Caribbean Sea to the vast South Pacific Ocean. Our overarching objective is to advance the world's scientific knowledge and provide countries around the world with essential information to counteract the decline in coral health. Coral reefs need a massive intervention through strong political will, sustained financial support, and wide-scale resource management. So far, we have learned that:

- The characteristics and health of coral reefs worldwide are stunningly varied across regions and, more remarkably, within local reefs on small scales.
- Most of the reefs we have surveyed exhibit signs of over-fishing; including very remote reefs. The extent of over-fishing is, in general, directly proportional to the proximity and density of human populations.
- With exceptions, our observations indicate a strong relationship between reef health and the abundance and diversity of fish. Therefore, implementing best fishing management practices should improve reef health.
- People most dependent on coral reef resources have a limited understanding of the threats to their reefs or the factors that promote reef health. There is a strong, global need for coral reef education and advocacy.
- The health of Caribbean Sea coral reefs has dramatically deteriorated over the past few decades. Overall, Pacific reefs are in better health but exhibit signs of following the same trend as Caribbean reefs. Time is of the essence to improve resource management and to minimize direct human stressors.
- Many countries of the world still have beautiful and relatively healthy and productive coral reefs that demonstrate resilience to large-scale disturbances. This gives us hope that, with wise resource management, reefs can survive long into the future.

Our findings to date alarm us by the global reach of this environmental crisis, increase our sense of urgency to close knowledge gaps and empower resource managers, and give us renewed optimism that nature is resilient and responds favorably when chronic, human stressors are removed or minimized. We are determined to be enablers of healthy and sustainable reefs worldwide! Many thanks to HRH Prince Khaled bin Sultan for generously supporting this historic scientific journey!



CAPT Philip G. Renaud, USN (Ret.)

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Science Without Borders®

The Khaled bin Sultan Living Oceans Foundation embraces *Science Without Borders*® in all facets of its operations. *Science Without Borders*® is registered to the Foundation for financial sponsorship of marine conservation programs and scientific research and to promote public awareness of the need to preserve, protect and restore the world's oceans and aquatic resources. The *Global Reef Expedition* has embodied the purposes of this trademark through both an unprecedented level of collaborative scientific research and an ambitious education and outreach program. Through the Foundation's scientific work, local resource managers and scientists from countries around the globe are receiving critical scientific information and tools to assist them in management and conservation of their marine resources. Additionally, local scientists work side-by-side with internationally acclaimed coral reef scientists. The international team of scientists aboard the research vessel, *M/Y Golden Shadow* map and survey coral reefs to close critical gaps in scientific knowledge. The Foundation also trains local scientists and resource managers to continue environmental monitoring long after the *Golden Shadow* departs the region. Following the field work in each region, the Foundation and its partners compile and analyze comprehensive coral reef data, satellite imagery, photos and video and use the knowledge to guide development of regional and global conservation tools and tactics to counter the most serious threats impacting the health of coral reefs.

Note: First use of this service mark by the Living Oceans Foundation in the United States was recorded on December 3rd, 2000. The service mark "Science Without Borders"® was officially registered on September 9, 2003, with the United States Patent and Trademark Office under Reg. No. 2,760,882. The registration was renewed for a ten-year period on January 3, 2013. The mark is also registered with the Registrar of Trade Marks in Australia as Trade Mark No. 1092400 and with the European Community as Trade Mark Reg. No. 4756797. Protection of the trademark is also registered in the Kingdom of Saudi Arabia. The mark is used to promote financial sponsorship of marine conservation programs and scientific research, as well as public awareness of the need to preserve, protect and restore the world's oceans and aquatic resources.



Global Reef Expedition Overview

The Khaled bin Sultan Living Oceans Foundation has now completed the third year of a five-year *Global Reef Expedition (GRE)* program (2011–2015). Our ability to access remote coral reef ecosystems, relatively unaffected by man, opens an important window into the ecological factors that promote reef health. Comparing the ecological conditions between remote coral reefs with reefs that have been compromised by chronic, human-induced stressors enables the Foundation to identify management priorities. The overarching goal of the *Global Reef Expedition* is to provide scientific knowledge and recommendations to resource managers and government agencies; bridging science with management to achieve sustainable and productive coral reef ecosystems around the globe.

The Foundation openly shares data and results with host countries and international stakeholders to empower resource managers with tools and decision aids that will influence policy and stimulate actions urgently needed to improve coral reef health. We proudly claim that this *Global Reef Expedition* is the first coral reef expedition in the history of humankind to employ standardized scientific protocols to map, characterize, and evaluate global coral reefs.

Conducting effective scientific research and developing conservation tools is only part of our strategy. The scale and urgency of the *Global Reef Expedition* is unprecedented and calls for an equally bold educational initiative. The Foundation's education program employs new learning technologies to deliver the urgent message of coral reef conservation and to underscore the direct contributions reefs make to people's lives, no matter where they reside.

By utilizing the latest educational technologies, film-making, internet curriculum, and social media, learners around the globe are able to directly participate in the Expedition and experience its scientific activities through virtual reality. Educators and students directly interact with working scientists to gain personal insight into real-world applications of marine science.

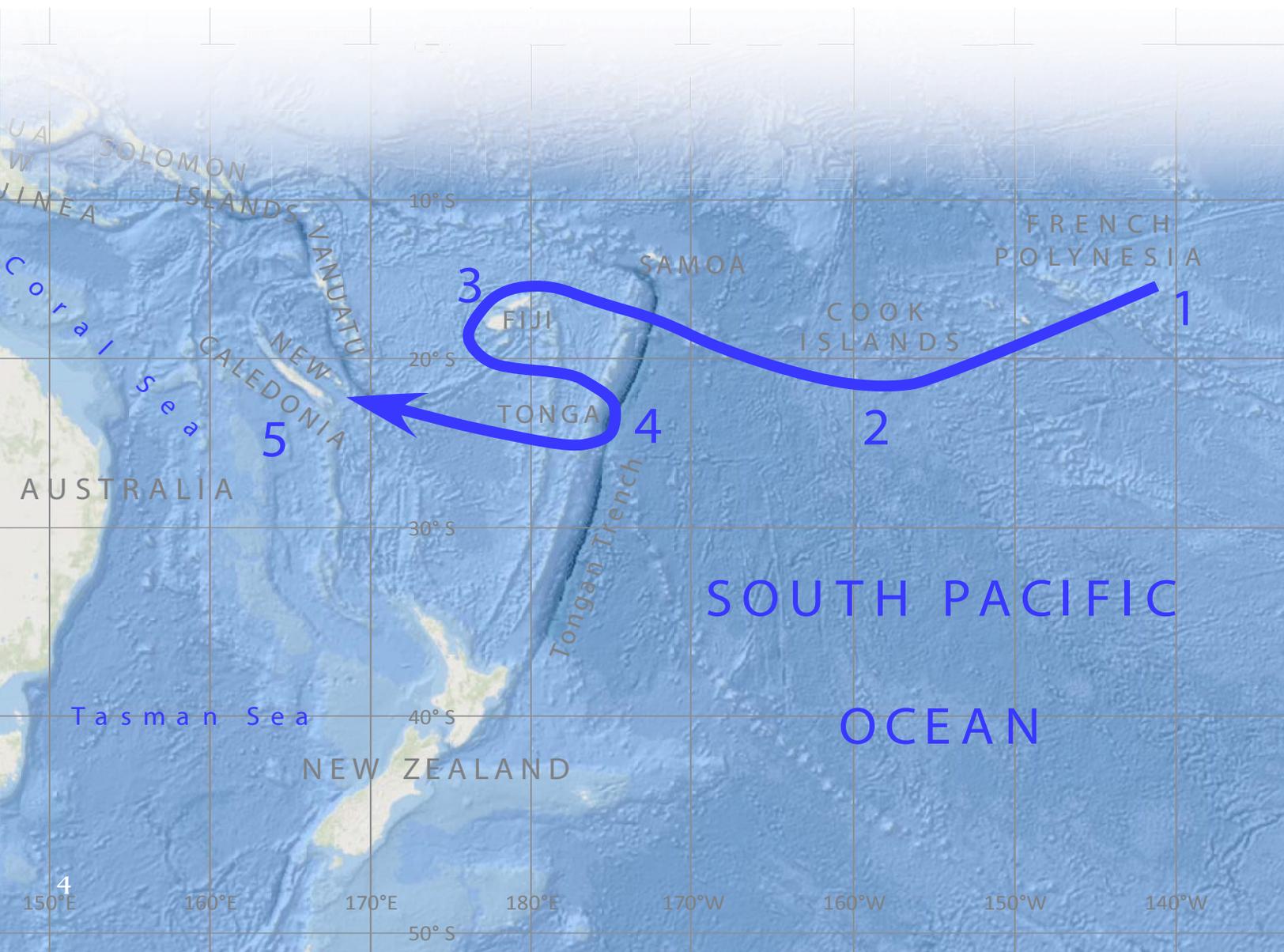
A "Reef Science Resource Center" is being established as a web-based teaching asset designed to support in-classroom experiences for both teachers and students. Through the CREW fellowship program (Coral Reef Educator on the Water), teachers periodically join the research team to help deliver content to millions of virtual learners. Both on-board and underwater experiences provide compelling educational access to the Foundation's work and discoveries. Scientists' journals and real-time broadcasts engage learners, motivating them to track the scientific processes, progress, and results, which will ultimately lead to an enhanced public understanding of these vital coral reef ecosystems.

GRE By the NUMBERS 2013

11,703,476	depth soundings were collected
255,494	minutes of dive time by all divers (178 days underwater)
121,065	corals were surveyed, measured, and catalogued
9,834	km ² of coral reef habitat were mapped
2,949	benthic surveys conducted
2,845	underwater videos of coral reef habitats collected
1,975	fish surveys conducted
1,001	coral surveys conducted
812	sediment samples were collected for analysis
371	separate reefs were thoroughly surveyed
185	days of research were completed in 2013
70	scientists participated in the research missions
43	different islands, atolls, and banks were researched
28	coral disease samples from 3 different diseases were collected
14	new species of fish were identified (total estimated)
5	countries were visited
3	years of the Global Reef Expedition have been completed
1	The most important coral reef expedition in the history of man

Pacific Ocean 2013

- 1 French Polynesia—January-April
 - Gambier Islands—January-February
 - Rangiroa—March
 - Austral Islands—April
- 2 Cook Islands—April-May
- 3 Fiji—June
- 4 Tonga—September
- 5 New Caledonia—October-November





Global Reef Expedition Research Missions

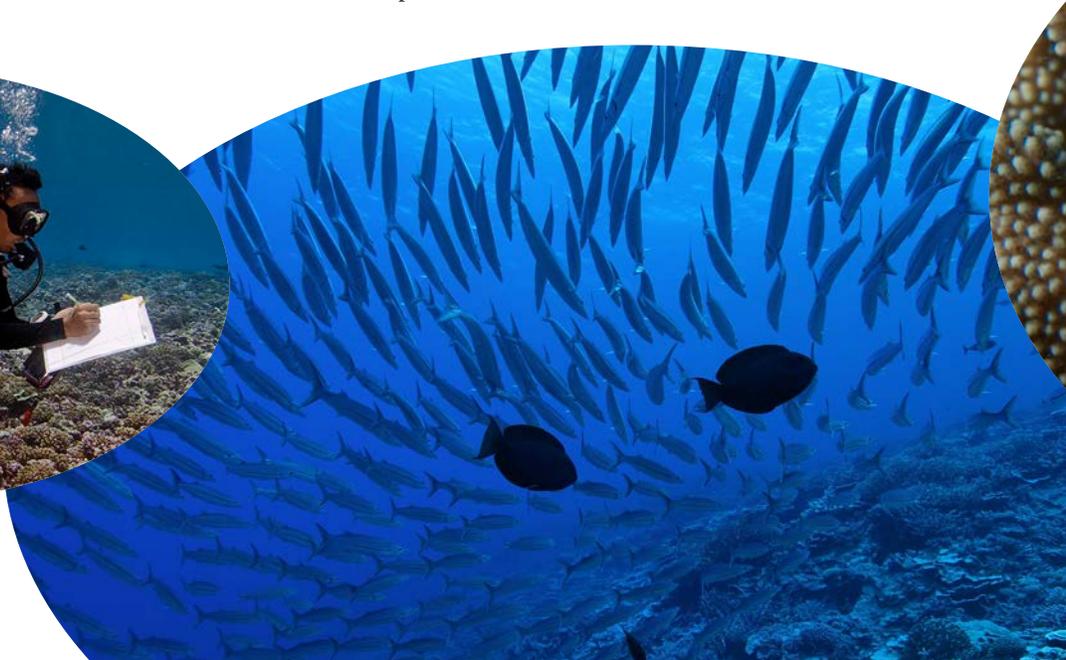
During 2013, the Living Oceans Foundation conducted seven research missions in five countries. Between January and April, we completed our habitat mapping, research and coral reef assessments of French Polynesia, targeting eight islands in Gambier, an extended study in Rangiroa, five islands in the Australs, and Moorea. After leaving French Polynesia, we surveyed three of the largest islands in the Cook Islands, 11 islands in the Lau Province of Fiji, three island groups in Tonga, and 10 islands in New Caledonia. Spending more than 164 days of combined bottom time underwater, we were able to assess and characterize 368 coral reefs. This effort represents a multinational collaboration, involving 22 scientists on each mission and representation from universities, government agencies and non-government conservation organizations in 13 countries – Science Without Borders!

Gambier Islands (January 14-February 12)

Our surveys of the Gambier Archipelago began with the uninhabited low-lying atolls of the Acteon group, followed by the volcanic, high islands of Mangareva. Fore reef communities in the Acteon group were remarkable examples of climax communities where a small suite of species had successfully out-competed other species and have dominated the reef. These old-growth forests of coral covered 60-80% of the bottom, extending from the water's surface to 30-40 m depth. These were some of the first reefs we've surveyed where there was no evidence of impacts from bleaching, crown of thorns starfish, cyclones or disease. The lagoon seascape of Mangareva was dominated by extensive thickets of *Acropora*. Large table corals, several decades old, formed a canopy towering above fields of bottlebrush and stag-horn corals that sheltered an incredible diversity of fish. Within this patchwork of coral communities another unique species of *Acropora*, best described as 'spindled' coral, flourished.

Rangiroa (March 8-23)

Rangiroa, the largest atoll in the Tuamotu Islands, and one of the largest in the world offers sharp contrast in coral reef communities. The middle of the lagoon is reminiscent of the open ocean – with strong winds, waves and current, deep water and no site of land. Lagoonal reefs, best developed near the rim of the atoll, have flourishing communities of fragile branching corals just below the water's surface, surrounded by mounds of massive *Porites* corals, some 4-5 m tall. Slightly deeper, the reef becomes a sand, rubble and seaweed slope, plummeting to the lagoon floor 40-50 meters below. Two narrow channels with swift currents, dense communities of cauliflower coral (*Pocillopora*), huge schools of snappers, and an abundance of sharks connect lagoon reefs with outer fore reefs and the open ocean. The fore reef completely encircles the atoll, with a dense assemblage of branching corals in shallow water, boulder corals at mid depths, and foliaceous lettuce corals on the deep fore reef slope.



Austral Islands (April 9-20)

At the southern extent of French Polynesia are the Austral Islands, a series of low atolls, high volcanic islands and uplifted reefs that are close to the southern extent of the coral distribution. Colder than other areas we examined, these support many species of corals that are rare elsewhere in French Polynesia, as well as a few unusual fish. Three of the islands had flourishing coral communities, although we discovered two previously unknown coral diseases in one location. The other two islands we visited were heavily impacted by a large scale crown of thorns sea star (*Acanthaster planci*) outbreak. These starfish number in the thousands during an outbreak, moving across a reef in waves eating every coral in their path. While they tend to prefer the fastest growing corals, species that tend to recolonize damaged reefs quickly, when food gets scarce they will eat slower growing, massive corals which can have a profound impact on the reef. This was what we witnessed. Entire reef systems completely void of any live coral. All that remained were the dead skeletons of several hundred year old Porites colonies, the main frame builders on these reefs. In many places, dead skeletons were draped in large mats of algae, while others had no coral, little algae and unnaturally high numbers of herbivorous long-spined urchins. The COTS outbreak that destroyed the coral reefs of the Austral Islands resonated strongly among the science team and prompted discussion on initiating a protocol for the removal COTS when observed on the reef.

Cook Islands (April 22-May 5)

The Cook Islands offered a contrasting picture of reef health. In Raivavae, a COTS outbreak had badly damaged the reefs a decade previously and recovery was underway. The flourishing reefs of Palmerston had unusually high cover of living corals composed of a very high diversity of species, large populations of apex predators like sharks and groupers, and healthy populations of parrotfish. Between these extremes was Aitutaki, where an active outbreak of COTS was underway. We were able to document damage already done by these starfish, characterize how the starfish had moved around the atoll, and identify the last remaining healthy stretch of reef, just in front of the outbreak. In attempt to save the coral that remained, this was our first large COTS removal initiative. Over 500 COTS were collected, measured, and destroyed. We discussed the current COTS outbreak to local stakeholders and provided them with guidance for ongoing efforts to mitigate the damage.



Fiji (June 3-26)

One of the most remote locations in Fiji, the Lau Province consists of over a dozen islands each with small villages run by a Chief, and minimal communication with the rest of Fiji. These communities value their precious coral resources and have taken steps to revitalize their ancestral community-based management practices that include networks of “taboo areas” (no fishing zones). In each island, permission to visit these reefs was only granted after a lengthy discussion with the village chief and elders, a celebration and blessing, and acceptance of our offerings of Kava. The effort was certainly worthwhile. A diverse ocean environment with barrier and fringing reefs facing the open ocean, and patch reefs, mangroves and extensive grassbeds inside lagoonal environments, the Lau Province represented the unspoiled beauty for which Fiji is reknown. Steeply sloping walls that quickly dropped into the deep blue abyss, interspersed with large pinnacles, caves, and undercut ledges. These were draped in soft corals, black coral, gorgonians, sea whips and seafans, forming a kaleidoscope of colors and sheltering a myriad of small fishes. Just as stunning, many of the tops of the pinnacles and the reef slope were carpeted with stony coral gardens. In addition to a very high diversity of corals, and areas dominated by unusually large, old growth stands of coral on the outer reefs, the lagoonal reefs supported unique coral communities. In one of the largest lagoons (Vanua Balavu) we found a reef constructed in entirety of immense mounds of a spiky branching coral called Galaxea – individual colonies were up to 100 m in diameter and 15 m tall!

Tonga (September 10-30)

Tonga is an archipelago located in Oceania (in the South Pacific Ocean) that includes 176 islands clustered in three main groups. The geological history of Tonga is quite diverse. Some islands consist of a limestone base formed from uplifted coral formations atop a submerged ridge that runs parallel to the Tongan Volcanic Arch and the Tongan Trench; some consist of a limestone cap overlaying an extinct volcano, while others are young, and active,

volcanically created islands with little coral development. The underwater world was highly varied and quite spectacular. Besides the frequent sightings of Humpback whales - which had migrated from their feeding grounds in Antarctica to the Kingdom of Tonga to court, mate and calve – we documented sea snakes, turtles, sharks and rays and other megafauna. Many of the locations we examined were lagoonal sites, which often had extensive high relief thickets of branching, bottlebrush and staghorn corals, slopes with single species stands of large foliaceous and plating corals, and boulder corals (*Porites*) that were often 5-10 m in diameter and centuries old. These reefs had the highest number of coral species documented to date on the GRE.

New Caledonia (October 28-November 24)

Our surveys of New Caledonia extended from the cold, southern waters around Pins, to turbid waters of Prony Bay and the gin-clear warm waters around the northern atolls, covering 5° latitude and 730 km as the crow flies. Pins, where the water temperatures dropped to 20° C (68° F), had several corals that are absent from reefs further north. The algal community here was also unique, containing both temperate (non-reefal) and tropical species. Prony Bay, at the southern end of the main island (Grande Terre) is surrounded by hillsides that are dark red and scoured by nickel mining activities- high rainfall and run-off from land reduces visibility and carpets the reef in a red layer of silt – creating what should be suboptimal conditions for corals. Nevertheless, these reefs supported flourishing coral communities with many rare and distinct species not seen elsewhere. As a contrast, the northern reefs had multiple canopy layers, with large tables of *Acropora* shading smaller massive and branching corals below. These reefs also had one of the healthiest fish populations seen to date. It was common to see dozens of groupers, at least 1-2 m in length, along with large schools of snapper, barracuda, sharks and other top predators.





Education and Outreach

Throughout 2013, the Foundation continues to support the work of the Global Reef Expedition through education and outreach. As part of the core values of the Foundation, we communicate the often complicated reef science to the public, especially to students. We do this through live events, seminars, workshops, photography exhibits, newspaper and web articles. We also produce films that educate the public about the importance of reef conservation. Our outreach and education activities reached thousands of people in 2013. Here are some of the highlights:

33



Articles and news stories featuring the work of the Foundation

16



Conservation films produced by the Foundation

6



Film production awards in recognition of the quality of our scientific communication

3,801



Students and teachers who attended Foundation education workshops

7



Public and government events where we presented scientific results

1



Visually powerful award winning web site launched



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Statement of Financial Position

December 31, 2013 and 2012

ASSETS	2013	2012
Current Assets		
Cash and cash equivalents	\$ 1,278,416	\$ 1,821,379
Prepaid expenses	28,176	21,894
Total current assets	1,306,592	1,843,273
Furniture and equipment, net	126,455	220,855
Other assets:		
Investment restricted for endowment fund	1,639,091	1,477,424
Deposits	4,589	4,589
Total current assets	1,643,680	1,482,013
Total assets	\$3,076,727	\$ 3,546,141
LIABILITIES AND NET ASSETS		
Current Liabilities		
Accounts payable and accrued expenses	\$ 125,563	\$ 69,692
Grants Payable	175,000	140,000
Total Current Liabilities	300,563	209,692
Total liabilities	300,563	209,692
Net Assets:		
Unrestricted		
Undesignated	463,337	985,289
Board designated—operational contingency reserves	673,736	873,736
	1,137,073	1,859,025
Temporarily restricted	—	—
Permanently restricted	1,639,091	1,477,424
Total net assets	2,776,164	3,336,449
Total liabilities and net assets	\$3,076,727	\$3,546,141

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