Tuvalu Marine Life

an Alofa Tuvalu Project

with the Tuvalu Fisheries Department and Funafuti, Nanumea, Nukulaelae Kaupules

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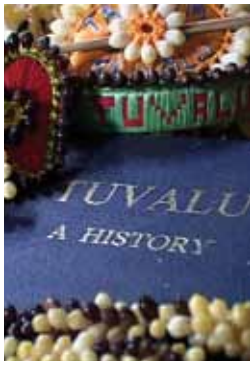
CONTEXT

TUVALU: a disappearing nation

Lost in the middle of the Pacific, 1100 km north of Fiji, between 176°E–180°E and 5°S–11°S, Tuvalu is an archipelago of nine low-lying islands – five true atolls and four raised limestone reef islands – spread over 900,000 km^2. With a total landmass of only 26km^2 – 1/2 of Manhattan, 1/4 of Paris –, the area of each island ranges from 0,41km^2 to 5,09km^2.

Independent from Britain since 1978 after 1 century as a protectorate and colony, Tuvalu – formerly known as the Ellice Islands – is a member of the Commonwealth and joined the United Nations in 2001. With a population of about 11,000 people, of primarily Polynesian descent, this very young nation, still in the process of learning how to manage its meagre human and financial resources, finds itself at the forefront of a planetary issue: climate change.



Living with this threat for many years now, some Tuvaluan people may seem resigned to their relative powerlessness. And there can be no mistaking that unless existing trends are addressed immediately the very future of Tuvalu is at stake. And with it, if nothing is done, the future of humanity. Tuvalu is the symbol of what awaits us all.

Life in Tuvalu is familiar in many ways, with one foot firmly rooted in the contemporary. Inhabited for thousands of years before the British arrived, history and tradition too are present. This is a unique society, oriented around family and community.

Christianity first came to Tuvalu in 1861. Today, though far smaller than the Church of Tuvalu (EKT) that gathers 90% of the population, half a dozen other denominations include the Brethren (EKT dissidents), the Catholic Church, the 7th Day Adventists, the Baha'is, the Mormons, the Muslims and the Jehovah's Witnesses, who in 1985 published the only English-Tuvaluan dictionnary. Untill 2008, when "Ka Lofia Te Paneta", Alofa Tuvalu's comic book was created, the Bible was the only book in Tuvaluan.

Tuvaluans are proud of their independence, but being barely a pin-prick on the map doesn't make economic matters easy. The economy is an eclectic mix, ranging from subsistance farming/fishing, to the sale of postage stamps and the .tv domain name. Tuvalu's economy is extremely susceptible to external economic influences such as changes in the price of oil.

With increasing imports, hard currency flows out like water… and with so little to sell, paying for many needs is a constant challenge.

Changing and increasingly erratic weather patterns, flooding due to sea level rise, increasing ocean temperatures and longer droughts are already putting Tuvalu's vulnerable environment under pressure and affect the freshwater supply as well as local food production.

As the primary source of fresh water, the rain – which can come and go in minutes, or last for days on end during the winter rainy season – is critical for survival.

TUVALU RELATION TO THE OCEAN

Almost every aspect of Tuvaluan life somehow relates to the water surrounding the ocean. Water is deliverer of food, controlling influence on weather and destroyer of precious land… an ever-present reminder of Tuvalu's blessing as well as its fragility. One clearly senses that the ocean, considered dangerous and unpredictable, is an element to be feared.

Not surprisingly, two of Tuvalu's primary sources of income are derived from the ocean: the sale of fishing licenses to foreign nations (Japan, Taiwan, the US etc.) and the wages from the nation's merchant seamen are so vital to the economy that the government heavily subsidizes the Tuvalu Maritime Training Institute – TMTI –.

Lack of capital, land, and manpower prevents the development of Tuvalu's hundreds of thousands of square miles of sovereign territorial waters, rich in tuna and cod, into a full-blown export industry. Fishing remains a local activity… a national sport and pastime which provides the nation's nutritional base. Those who don't fish, buy from the professional fishermen.

Besides fish, other locally grown foods include pork, bananas, breadfruits, coconuts and papayas. Imported rice has steadily replaced traditional root crops such as taro and pulaka, which have become difficult to cultivate due to the infiltration of saltwater.

As time goes on, the pressure on marine resources is increasing. The lack of means to control unlicensed foreign vessels (only one patrol boat), use of more sophisticated fishing gear, a rapidly increasing population, and the trend towards a money-based economy, are further threatening Tuvaluan food sustainability.

In Tuvalu, there is strong anecdotal evidence that marine fish stocks have indeed declined over the last 15 years. It now takes 4 times longer than before to fish and, according to fishermen, reef fish are getting smaller. Fishing grounds have moved further away from shore and with increasing oil prices, a day without any fish in the nets is a calamity.

There are other serious consequences of climate change, with rising temperatures also impacting ocean currents and migratory patterns of tuna like species. A related issue – ocean acidification due to increasing atmospheric CO^2 – threatens to throw off the equilibrium of the entire planet's marine biology.

ALOFA TUVALU: The NGO

“Helping to save Tuvalu means helping to save our world too”

In 2003, Alofa Tuvalu’s initiator Gilliane Le Gallic, a French journalist, producer and director, makes a first trip to shoot “Trouble in Paradise: Tuvalu a disappearing nation” with co-director Christopher Horner. As most of the world’s population, many Tuvaluan people are unaware of the threat of climate change. Le Gallic makes the decision to help Tuvalu beyond the film and her assistance plan, “Small is Beautiful” (SIB) gathers the Tuvaluans around its objectives: helping Tuvalu survive as a nation and, if possible, allowing Tuvaluans to stay on their ancestral land.

By helping Tuvalu become the first replicable model of an environmentally exemplary nation, the plan contributes to its future survival and helps solve some of its urgent waste and energy problems, as well as preserving what makes Tuvaluan culture and tradition unique.

In early 2005, Alofa Tuvalu – the NGO – is born in Paris and soon after in Tuvalu. Then a communication campaign begins, addressing a worldwide audience by using the concrete and reproducible activities implemented in Tuvalu. The objective is to participate in an active, global movement to create tools for safeguarding our environment and hopes of a solution for us all.

Although all aspects of the environment are part of Alofa Tuvalu activities, the NGO chooses to first focus on energy – energy efficiency and biomass fuels – with French Foreign Affairs, ADEME and the US Embassy in Fiji amongst its funders.

At the request of Tuvalu's government, a National Energy Study is completed. In 2006, after presentation to the Cabinet and members of parliament, its main recommendations are included in the country's energy policy. From then on, Alofa Tuvalu's specialists progressively promote the importance of combined renewable energies. In partnership with the Tuvalu Maritime Training Institute (TMTI) pilot units are implemented and several hundreds of people are trained and introduced to biogas from pig waste, biodiesel from coconut oil, ethanol from todi, coconut shell and husk gasification.

At the request of the Nanumea community, the first installation on an outer island is completed in 2012 with 4 family-sized biogas digesters. Workshops, radio programs, screenings, electric motorbikes and solar oven demonstrations are also part of the awareness outreach programs.

The film and SIB contributed to the emergence of the climate refugee concept. Unfortunately, that concept has not yet been transformed into an official status or protection act.

In 2007, Tuvalu's Cabinet unanimously nominates Gilliane Le Gallic "Goodwill Ambassador for the Environment of Tuvalu". The same year, SIB is chosen by UNESCO as one of the Remarkable Actions of the 2004-2014 Decade for Education in Sustainable Development.

Actions in Tuvalu combined with repeated local and international campaigns, (including children's awareness events) generate an unprecedented interest in this symbolic small nation. While biofuel production is being initiated worldwide, being fossil fuel independent by 2020 becomes one of the objectives of the Tuvalu Government.

THE STORY BEHIND THE SURVEY:

Opportune coincidences paved the way to "Tuvalu Marine Life"

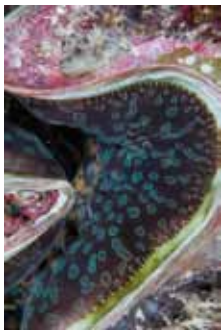
In 2006, while looking for funds for its biofuel implementations and training activities, Alofa Tuvalu met Total representatives at a conference. For ethical reasons, Total had not been contacted. This was, however, an opportune coincidence. Although no partnership on biofuels could be considered, the Total Foundation offered to assist with a marine biodiversity project.

Gilliane Le Gallic and Semese Alefaio, initiator of most of the Conservation Areas (small, locally managed no-take areas) in the Tuvalu archipelago, summarized the community's needs into the "Tuvalu Marine Life" project (TML). This project consisted of an exhaustive documentation of fish stocks and a reference document for further research, in order to find sustainable solutions to preserve biodiversity and food security as well as to prevent natural resources from being lost forever. In 2008, the Total Foundation, in association with Total Fiji, confirmed their partnership on the project.

The second funder came along when, soon after, Gilliane met marine life specialist Sandrine Job in Tuvalu. She was working under an AFD (French Agency for Development) initiative in the Pacific. She offered her technical assistance with CRISP's (Coral Reef InitiativeS for the Pacific) funding for the literature review, the first step of the project. Through CRISP, the project also received a donation from Sue Devitt Beauty (USA).

Alofa Tuvalu and Tuvalu Fisheries completed the funders' list and many individuals in several countries donated their time and knowledge to help make the project happen. Sandrine approached Dr. Daniela Ceccarelli (marine ecology consultant) and Thomas Vignaud (marine biologist, underwater photographer) to complete the team.

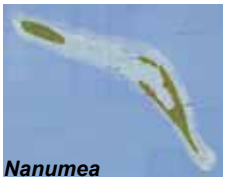
Surfing on the country's unique rhythm, climate conditions, unpredictable planes and inter-island vessel schedules, lack of human resources, workforce volatility and political feuds… It took 7 years to achieve the project.



Just to mention a few of the people behind the friendly support that are not mentioned elsewhere: Laure Fournier, Laurence Lainey & Eric Freycenon (Total Foundation), Eric Clua (CRISP), Dominique Rojat (AFD), Seinati & Willy Telavi (Tuvalu PM), Nala & Apisai Ielemia (Alofa Tuvalu Patron/ former PM & present Foreign Affairs, Environment, Trade, Tourism and Labor Minister), Penieli & Lotoala Metia † (Alofa Tuvalu Committee / Minister of Finance), Tine & Lilian Leuelu (Tuvalu Ambassador to Brussels), François Letourneux & Christophe Lefebvre (IUCN), Michel Hignette & Dominique Duché (Aquarium tropical de la Porte Dorée), Bruno Gain (Ambassador, former Permanent Secretary for the Pacific), Christiane & Michel Monnier (former French Ambassador to Fiji), Fanny Douvere (World Heritage Center), Marie-Pierre Cabello (SERE), Martine Cartier (Cartier Conseil), Patricia Ricard (Institut Océanographique Paul Ricard), Eti Esela, John Hensford & Kaio Tiira Taula (APNL / Alofa Tuvalu), Linda Cohen, Michel Courillon, FarraH Diod, Sarah Hemstock, Christopher Horner, Kent, Line Lavesque, Yves Leers, Sikeli Raisuqe, Leonie Smiley, Gilles Vaitilingom. Our hearts go to Elega & the Alofa Tuvalu Peninsula kids…

THE STUDY

OBJECTIVES, SCOPE & STEPS



Nanumea

Nukulaelae

Funafuti

Documentation of fish stocks is not a new concept in Tuvalu. Over the years, the Department of Fisheries, the Conservation Office of Funafuti Kaupule (local town council) and regional institutions have gathered raw data. However, this information was fragmented as each of the institutions recorded them independently.

Although all islands have set up Conservation Areas, Tuvalu's marine biodiversity had no definitive reference point in any of the existing documentation or scientific publications. The aim was to create a baseline, as exhaustive as possible with the available means, on national marine biodiversity.

The 1st step November 2008 – July 2009, involved producing an extensive literature review of previous data, publications and reports to avoid replicating past field efforts.

The results of the literature review were restituted to all concerned in Tuvalu. Other data, provided by local stakeholders, fed the review further. The document referred to as "Job 2009" was published in July 2009.

Gaps in the existing documentation were identified and the decision was made to carry out complementary field surveys on 3 atolls of the 9 islands.

- the closest to the Equator, Nanumea (3,1 km^2,), 665 inhabitants
- the southern atoll, Nukulaelae (1,66 km^2 ; 950 km away from Nanumea), 400 inhabitants
- the main capital atoll, Funafuti, the second largest, (2,54 km^2), at the center of the archipelago, 755 km away from Nanumea and 190 km from Nukulaelae, 4500 inhabitants

The field surveys took place from April to June 2010 with emphasis on reef fish and invertebrates as major components of food security. The objectives were to assess marine resources within and outside Conservation Areas with 3 study components:

- Daniela Ceccarelli led the Fish Biodiversity Survey to update and expand existing fish species lists, to provide additional information about abundance, species composition, biomass and distribution patterns.
- Sandrine Job focused on a survey of a targeted species list established by Tuvalu fisheries: 65 fish and 20 macroinvertebrates, selected for their value to island communities (food, handicraft etc). The objectives were to assess stocks in the Conservation Areas and to test the effectiveness of protection. This was the first survey of its kind on the outer islands.
- the 3rd component to serve future management purposes was to train local people and 'refresh' Fisheries officers in techniques used to assess marine resources.

The fieldwork report, referred to as "TML Fieldwork Report" was published in July 2010. A synthesis report for users, referred to as "TML Synthesis Report" was delivered to local stakeholders for comments in December 2011.

Analyses of survey results are consolidated into the "Scientific Report", referred to as "Job & Ceccarelli 2012". Electronic copies are made accessible and available data are shared.

Early 2013, TML reports and updated species inventory are assembled into 4 "booklets". Gathered into a publication, printed in a limited number of copies, they also can be consulted separately.

METHODS

In all stages of the project (literature review, restitution, preparation, surveys, data analysis and reporting) stakeholders were consulted and in many cases directly involved. Among the requests was that marine resource surveys within established Conservation Areas should hinge on simple, replicable methods easily applied by members of local communities to assess their local stocks and manage their coastal resources.

To establish collaborative management, one objective was to strengthen the capacity of individual team members by enhancing awareness and resource management. Meetings with the local Kaupules (elected island council), workshops with fishermen, Falekaupule/Kaupule, relevant government agency representatives and training sessions on land and in water were conducted on each island. Globally accepted standard sampling protocols were used, including timed swims and belt transects.

On each atoll between 9 and 14 sites (35 sites altogether) were visited in three major habitats (lagoon, sheltered outer reef, exposed outer reef), one additional habitat (lagoon pinnacles) was surveyed on Funafuti atoll. For the Conservation Areas, scuba was only used for the Funafuti lagoonal sites; all other sites were surveyed by free diving.

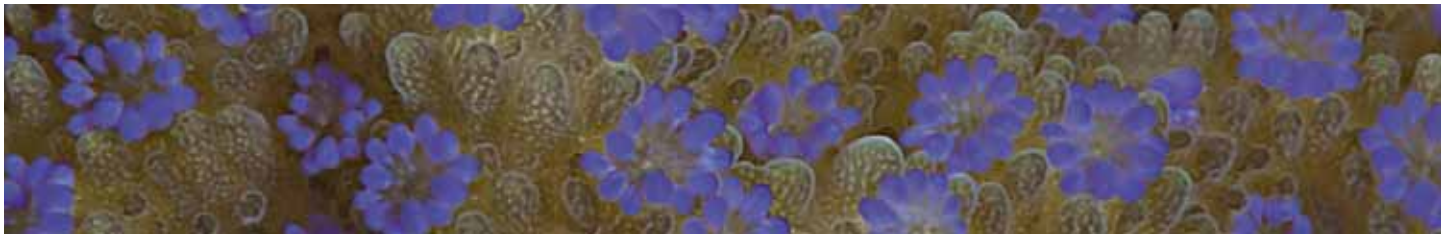
CONCLUSION

The first comprehensive Tuvalu fish survey recorded 358 species (Jones et al. 1991) on Nanumea, Nui and Nuitao. *Tuvalu Marine Life* inventoried a substantial number of marine species, bringing the total to 1526 (607 fish, 409 macro-invertebrates, 379 Cnidarians, 59 Algae, 41 Birds, 21 Mammals, 4 Sponges, 4 Turtles, 2 Mangroves). The revised 2009 AT bibliography had listed 1449 species. In 2010, in Nanumea, Nukulaelae and Funafuti, the TML team observed 66 new reef fish and 11 macroinvertebrate species that had not been previously listed. The new species recorded are mostly common reef species. Their absence on previous lists is testimony to the relatively low effort that has gone into documenting Tuvalu's marine life in the past. No endemics were recorded.

Fish densities and benthic communities reflect relatively low fishing pressure and reasonably healthy reefs in most areas. The overall mean target fish density was higher on Funafuti atoll, despite signs of overfishing and nutrient enrichment, with turbid water, high macro-algal cover and occasional presence of black algae and jellyfish along populated shores.

Although there appears to be sufficient fish for local consumption, overfishing and potential effects of climate change could put the country's future food security at risk.

Mean edible macroinvertebrate density was considered low on the 3 surveyed atolls. Giant clams and sea cucumber stocks have declined dramatically. Clams are listed in Appendix II of CITES (1983) and are considered vulnerable under the IUCN Red List of Threatened Species (1996). No living specimen of the giant clams, *Tridacna gigas* (Fasua in Tuvaluan) were found in Nanumea. Almost no commercially valuable sea cucumbers were observed on the 3 islands, a consequence of a commercial fishery that took place for a number of years.



At least 79 fish species of interest are listed in the IUCN Red List, of which 29 are included in Near Threatened or Threatened categories.

Species of concern include the bigeye tuna (*Thunnus obesus*), the bumphead parrotfish (*Bolbometopon muricatum*), the Maori wrasse *(Cheilinus undulatus)* and a number of species of groupers -*Epinephelus lanceolatus, Plectropomus aerolatus* and *P. laevis*.

These species, as well as the rays and the sharks at the higher end of the food web should be the object of a preservation strategy. It may also be necessary to extend management programs to include foreign fisheries operating within Tuvaluan waters. More generally, an effort should be made to raise awareness, including among children, about the need to protect lagoons and land.

It is too early to identify definite effects of protecting marine resources within Conservation Areas. No baseline existed for most of them. Today, TML provides a definite reference point for the Nanumea and Nukulaelae Conservation Areas and standard comparative data for Funafuti.

The achievement of *Tuvalu Marine Life* is only a starting point -- not a conclusion. While it contributes critical new knowledge to the international community, we expect that with additional research efforts, the species richness estimated here can be further protected and enhanced.

We wish for *Tuvalu Marine Life* to be of use for future local monitoring of marine resources and biodiversity, as well as for understanding the severity of the impacts of climate change.

We hope that it will help Tuvalu Conservation Areas to be included in the World Heritage Marine Programme.

Above all, we aspire for TML to be of benefit to the people and future generations of Tuvalu.In the devastating prospect of Tuvaluans having to evacuate their land and waters, this publication represents a unique history and testimony of Tuvalu's marine environment.

The TEAM

Many people participated in the TML project on each island. A core team developed and carried out the project (Table 1), and was joined by local field survey participants in each location (Table 2) benefitting from many people's kind assistance (Table3).

Table1 :

Gilliane Le Gallic, Alofa Tuvalu President, General coordination
Semese Alefaio, Marine biologist, Community-based related aspects, CA surveys
Fanny Héros, Alofa Tuvalu Project officer, Assistant general coordination
Sandrine Job, Marine biologist, Literature review, field coordination, CA surveys, habitat survey
Daniela Ceccarelli, Marine biologist, Coral reef fish biodiversity survey
Tupulaga Poulasi, Fisheries officer, Community-based related aspects, CA surveys
Séverine Jacquet, Alofa Tuvalu Treasurer, engineer in water science and technology, Phd in marine environment
Thomas Vignaud, Marine biologist, Underwater photographer

Table 2:

Patea Sela, CA survey, Nanumea
Esela Lopati, CA survey, Nanumea
Tahaoga Isako, Boat driver, Nanumea
Patrick Malaki, Boat driver and CA survey, Nanumea
Kaufiti Saloa, Boat driver, Nanumea
Morris Melitiana, Boat driver and CA survey, Nanumea
Iosua Filiki, Boat driver, Nukulaelae
Monise Peni, Boat driver, Nukulaelae
Faiva Namoliki, CA survey, Nukulaelae
Kinieti Pene, CA survey, Nukulaelae
Iosua Tepaolo, CA survey, Nukulaelae
Mataua Lima, CA survey, Nukulaelae
Lee Faiva Moresi, now Ministry of Finance, CA survey, Nukulaelae
Simon Salea, Manaui Crew, CA survey Nanumea & Nukulaelae
Tennis Manu, Boat driver, Funafuti
Nelly Senida, Manaui Crew Boat driver, Nanumea & Funafuti
Panei Togapili, Tuvalu Fisheries, CA survey, Nukulaelae & Funafuti
Teulu Sigalo, Tuvalu Fisheries, CA survey, Nanumea & Funafuti
Paeniu Lopati, Tuvalu Fisheries, CA survey, Funafuti!
Kirisi Salanoa, The Funafuti Conservation Area, CA survey, Funafuti
Moio Finauga, Tuvalu Fisheries, CA survey, Funafuti
Aso Veu, Tuvalu Fisheries, Boat driver, Funafuti
Sam Finikaso, Tuvalu Fisheries

Table 3:

Nanumea people: Teu Manuella, Filofale Taofusi, Tafito Miho, Fati Petolua, George Teaso ; Nmea Kaupule members: Eli Teuea, Tie Maheu, Isala katalake, Tuivaka Paitela, Toai Vevea, Muna Tefeke
Nukulaelae people: Maly Tulimanu, Letioa Tom, Pua Koliano, Mamele Galu, Silika
Lenese, Tamiloga Silo, Luta Lake ; Nkulae Kaupule members: Ekueta Telava, Tom Lake, Petaia Mose Paeniu, Kelisiano Losefa, Faiva Tinei
Funafuti Kaupule members: Andrew Ionatana, Uluao Lauti, Meneua Teagai, Kaitu Nokisi, Apinelu Tili, Heiloa Loua, Suka Taupale
TANGO: Taukiei Kitara
The Manaui crew: Tima Talapai, Mauatu Tepoga, Kaumoe Pene, Kokea Toaki
Tuvalu Department of Environment: Mataio Tekinene
ForamSand Project: Fumiko Matsudate
New Zealand Department of Conservation: Annie Wheeler and Dan Breen
NBSAP: Eliala Fihaki
NAPA: Nakala Nia
Radio Tuvalu
Vaiaku Lagi Hotel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Appendix:

PHOTO CREDIT:

Most of marine photographs: **Thomas Vignaud**
Other underwater report photographs: **Daniela Ceccarelli, Sandrine Job, Semese Alefaio**
Tuvalu, Funafuti, Nanumea and Nukulaelae maps: **Tuvalu Department of Land and Survey**
Additionnal pictures in the preamble were supplied by other Alofa Tuvalu members:
Jocelyn Carlin, Fanny Héros, Christopher Horner, Gilliane Le Gallic
Other photographic sources in the publication:
Aerial pictures: **Google Earth**
FishBase *(Froese and Pauly 2011):* most of them from **Dr J.E. Randall**

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