
FRENCH POLYNESIA

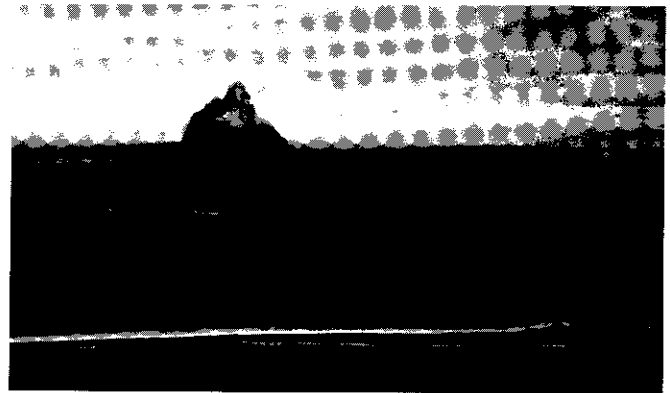
STATUS OF CORAL REEFS IN FRENCH POLYNESIA

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French Polynesia extends over 2,500,000 km² of ocean from 134°28'W (Temoe) to 154°40'W (Scilly) and from 7°50'S (Motu One) to 27°36'S (Rapa) (Figure 1). Emergent land totals about 4,000 km² and there is about 7,000 km² of lagoon. The islands are located in a general NW-SE orientation, their age decreasing from northwest to southeast, and they form five distinctive archipelagoes: Society, Tuamotu, Gambier, Marquesas and the Austral Islands. There are around 130 islands, of which 84 are atolls; most of the remainder are high volcanic islands, many being very mountainous with inaccessible interiors.

Since 1965, numerous missions have been undertaken to study the marine life of the area within the context of interdisciplinary studies of island ecosystems (Salvat 1976). The main objectives of research programmes are to study the wealth and productivity of reef ecosystems. A bibliography of the main references on the reefs of French Polynesia is given in Gabrié and Salvat (1985). Around 70 islands have been visited by scientists from the MNHN-EPHE (now CRIOBE) and publications have appeared on 30 of these islands.



The Tuamotu Islands are the best known scientifically. Moorea, Tahiti and Manuae in the Society Islands are also well known. Missions were also undertaken to the Marquesas and Gambier Islands. Extensive work, largely fisheries oriented, is carried out by ORSTOM which is based on Tahiti (Monnet et al. 1986). Additional work on fisheries, particularly the pearl fishery, is carried out by EVAAM.

The population of French Polynesia has increased rapidly since the 1920s, reaching about 212,100 in 1994. Over 70% of the population is concentrated on the Leeward Islands, particularly Tahiti and Raiatea, placing the reefs and marine environments of this region under greatest pressure. The other high volcanic islands are less at-risk due to their lower populations, but atoll environments are very vulnerable. Reefs are being affected by dredging, coastline alteration, filling, and discharge of sewage. The discharge of sewage and industrial effluents is widely recognized as a problem, as well as the disposal of rubbish.

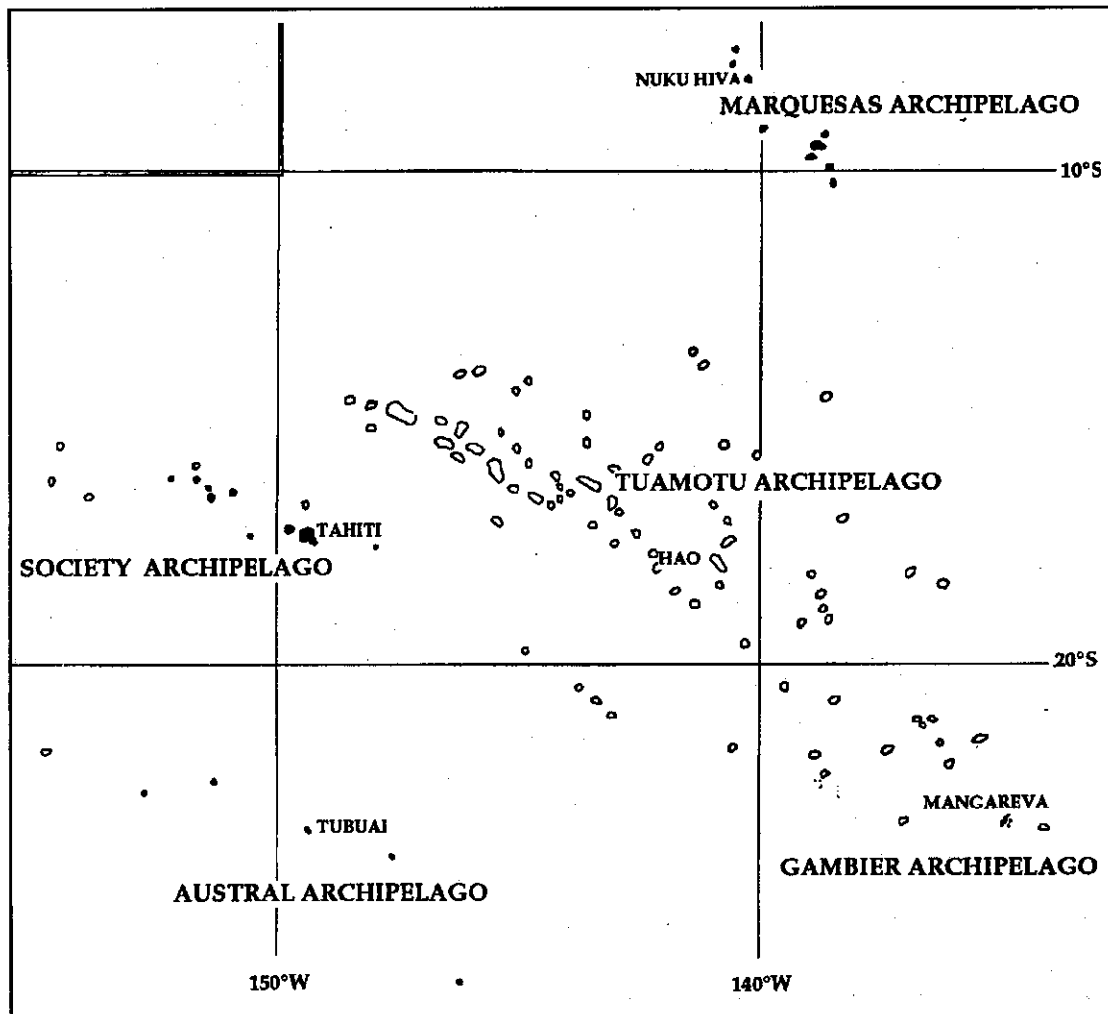


Figure 1. Map of French Polynesia.

The tourist industry is expanding rapidly and tourists have increased in number from 82,822 in 1975 to 140,000 in 1993 (Gabrié 1995). This growth is facilitated by the improved domestic flight service and the construction of hotels on many islands. Reef-related activities are of growing importance. The number of islands with resorts is increasing although Tahiti and Moorea still account for more than 80% of the total hotel capacity (Gay 1993). A recent trend is the development of resorts on the atolls and the resultant increase in domestic air services. Many of these hotels cater to reef-related recreational activities. In addition, there are recreational boating activities concentrated around the main islands (Tahiti, Moorea, Bora-Bora). The following recreational activities may have impacts on reefs: walking on the reef; collecting shells; diving and snorkeling; and a variety of motorised vessels used by tourists. These activities in general only take place in limited areas of reef, immediately in front of hotels, but the impact they have, and the relative importance of the different activities, is difficult to assess as no studies have been carried out. Tourists also may have disruptive effects on seabird colonies if they are allowed uncontrolled access, as on Tetiaroa. The development of fisheries, pearl culture and tourism create many user conflicts and cause pollution to the environment. Nuclear testing on Moruroa and Fangataufa Atolls is now stopped but environmental risks still exist.

The Reef and Natural Conditions

The main reef formations are found around the high islands and atolls although there are several oceanic banks of variable form (e.g., Ebrill Reef in the Gambier Islands and Moses Reef in the Austral Islands). Lying at the easternmost extremity of the Indo-Pacific Province, French Polynesia is at the limit of the axis of decreasing species richness and has a comparatively poor coral fauna. This is accentuated by the prevailing currents and winds which hinder the dispersal of larvae from the western Pacific, relatively low water temperature compared to the western Pacific, and the remoteness of the islands from continental masses. Many western Pacific genera are not found (e.g., *Symphyllia*, *Oulophyllia*, *Seriatopora*, *Goniopora* and the families Merulinidae and Euphyllidae) and only 18 species seem to be endemic to the region. Other characteristics typical of a marginal area are a high species diversity within some genera (e.g., *Psammocora*, *Pocillopora*, *Leptoseris*, and to a lesser extent *Montipora*) and an abundance of some taxa which are uncommon or absent in the central Indo-West Pacific such as *Sandalolitha* and *Porites irregularis*.

The eastern trade winds predominate from October to March. Annual rainfall affects the mean temperature through a warm rainy season from November to April and a relatively cool and dry season exists from May to October. From April to June, there are long calm periods broken by occasional cyclones, which generally arrive from the northeast and northwest. Within this general pattern, there are significant differences between the archipelagos (SPREP 1980a, 1980b, 1980c). Cyclones have been rare in the past, averaging one per century to the north of the Marquesas, one to three per century from the Marquesas to the region north of the Tuamotu group, four to eight per century from the Tuamotu group to the Gambiers and one every two or three years in the Austral areas. The year 1982-83 was exceptional in that five cyclones occurred (Nano, Orama, Reva, Veena and William), related to the abnormal El Niño conditions of that period, and were accompanied by abnormally low sea levels. Tides are semi-diurnal, with an amplitude rarely exceeding 40 cm. Sea water temperature decreases southward and eastward to Rapa where the minimum temperature suitable for coral growth is found. Summer temperatures are 26-30°C and winter temperatures are 20-22°C.

Status of Coral Reefs

The Scleractinia of French Polynesia are described by Chevalier (1981) and listed in Pichon (1985a); 168 species in 51 genera have been identified, including a few ahermatypic forms such as *Culicia* and *Tubastraea* but do not include deep-water ahermatypic corals. Although the Acroporidae show the highest species diversity, the Poritidae and Agaricidae are dominant in biomass, particularly around high islands, and the Pocilloporidae and some Faviidae are abundant in the atolls. In general, the coral fauna of the high volcanic islands surrounded by fringing or barrier reefs is richer than that of low atolls on banks. Many species are found only on the reefs adjacent to volcanic islands. For example, *Psammocora*, *Synaraea*, *Pachyseris*, *Pavona* and closely related genera are more abundant on fringing or barrier reefs than on atolls. Generally, the fauna of the outer slope and reef rim varies only slightly from one atoll to another but the coral fauna of the lagoons may be very different depending on depth and degree of exchange with the open ocean. Open atolls have a richer fauna than closed atolls, and in the former, the greatest coral diversity is found near the passes. In closed or semi-closed lagoons, the coral fauna may be much impoverished and dominated by *Porites* and *Acropora*. The Tuamotu and Society Islands have a moderately high coral diversity, with large reefs and a variety of reef types. These two groups of islands are of particular interest as

they were the subject of Darwin's early studies of reef morphology and evolution (Glynn and Wellington 1983).

Status of Other Organisms on the Reefs

Richard (1985) provides a list of all marine invertebrate, fish and algae species recorded in French Polynesia and a bibliography of references related to marine fauna and flora. The marine molluscs have been particularly well studied (Salvat 1967, 1970, 1973a; Lavondes et al. 1973; Richard 1974; Salvat and Rives 1975). *Cypraea obvelata* is endemic to French Polynesia. *Tridacna maxima* is the only member of the family Tridacnidae to occur in French Polynesia (Richard 1977); it is found in all the archipelagos except the Marquesas. *T. maxima* is very abundant in the lagoons of the Tuamotu atolls. Although not exploited to any great extent at present, its high productivity has considerable potential.

The fish of French Polynesia have been described by Randall (1973, 1978), 800 species in 90 families have been recorded. A total of 246 fish species have been recorded in the Gambiers (Fourmanoir et al. 1974). The fish fauna of the Marquesas is described by Plessis and Mauge (1978); it seems to resemble that of the rest of Polynesia but is slightly less diverse. Marine algae are listed by Payri and Meinesz (1985).

Major Disturbance and Exploitation

French Polynesia periodically suffers severe hurricane damage. However, it is not known to what extent the reefs and damaged by these events. Three of the five cyclones which affected French Polynesia in 1982-83 passed close to the Society Islands and caused significant reef damage, as well as in other areas (Dupon 1986). Furthermore, from mid-March to the end of May 1983, the mean sea level dropped by as much as 20-25 cm below normal in the Society Islands (Rougerie and Wauthy 1983) causing extensive death to corals, algae and reef biota close to the surface. For example, large areas of the reef died at Moorea. This prolonged period of low sea-level and cyclonic disturbance was probably related to the abnormal El Niño which occurred at that time (Glynn 1984; Pirazzoli 1985).

There have been some outbreaks of *Acanthaster planci*, for example in Moorea 1978-83, which affected shallow water, coral communities and increased the amount of macroalgal growth. Since 1980, and all around the world, coral bleaching events are of increasing importance. These events are correlated with periods of El Niño and unusual high temperatures. In 1983, 1984, 1987 and 1993, bleaching was moderate, while in 1991 and 1994 most reefs in the Society Islands were affected. Subsequent coral mortality occurred on some reefs (Salvat 1992a, 1992b).

Fishing is an important activity, ranging from traditional subsistence to commercial fisheries. At the end of 1990, the annual catch from the lagoon by the artisanal fisheries was about 5,500 tons; by comparison, offshore production was 2,100 tons (Chauvet and Galzin 1990). Thus, 72% of the fish landed in French Polynesia in 1990 came from the lagoon and 28% from the open sea. Much of the catch comes from the Tuamotu atolls, but because of population increase, the production of the Society Islands is suddenly becoming important. The catch is generally consumed locally although exports are starting with the growth of Papeete as a port and the development of domestic flights. More than 64% of the fish sold in Papeete market comes from the Tuamotu Atolls, 23% from the Society Islands and 13% from other archipelagos. Some deep-sea fishing occurs on the outer slopes of some of the atolls. La-

goonal fisheries include fish, molluscs, crustaceans and echinoderms. Overfishing has been reported in a number of areas (Serra et al. 1995).

In certain areas of the Society Islands extensive overfishing of coral reef fishes has occurred as a result of spearfishing and the use of fine meshed nets. Many areas are almost completely devoided from mature-sized fish, which means that breeding populations have been severely depleted. It appears that accurate figures of fish landings are only available for fish sold through the fish markets in Tahiti. Production was 2,300 tons in 1991 but fell to 2,000 tons in 1992. No figures are available for the number of fish and species composition of fish harvested by traditional subsistence fishermen. Ciguatera is a widespread problem and major research on this is carried out at the Louis Malarde Institute on Tahiti.

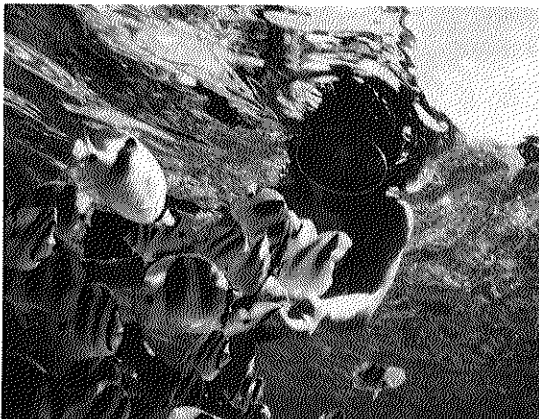
Trochus niloticus was introduced in 1954 and some commercial exploitation has occurred since 1972. Bag limits have been introduced and certain areas declared off limits for collecting this species, but these regulations are rarely enforced. The commercial viability of the green snail (*Turbo marmoratus*), which was introduced in 1967, is in doubt although currently no legal fishing is allowed. The indigenous species *Turbo setosus* and the giant clam *Tridacna maxima* are decimated because of increasing human predation.

Three species of sea turtles are traditional Polynesian food, although they have been protected since 1971. A recent regulation passed in July 1990 reinforces this protection, but currently no detailed information is available on turtle numbers.

Pearl oysters were intensively collected for their mother-of-pearl (*Pinctada margaritifera*) from the early 19th century to about 1950 when production started to fall due to overexploitation. Exploitation peaked at 1,400 tons although maximum sustainable yield is probably about 1,000 tons. Both the mother-of-pearl and pearl industries are now thriving as a result of the development of culture techniques. Exports of the highly valued black pearls from the black lip oyster have increased since 1972 due to increased culture operations following a decline in natural stocks in the 1970s. The pearl industry has the highest export value of any product in Polynesia since 1983. Black pearls constitute over 80% of the total value of exports from French Polynesia, about 8 billion of CFP (Gabri  1995). Of the 152 fishing cooperatives in French Polynesia, 91 are concerned with mother-of-pearl and pearl culture. These are found on 46 islands and atolls. Hatchery production has not been successful and natural stocks are used; either adults are collected by divers, or spat are collected and reared. Growth of pearl farming has created a demand for living oysters which are able to withstand the grafting operation. After high mortality rates in mollusc populations in 1984 and 1985, a general research programme on the mother-of-pearl oyster has started with

participation of EVAAM, IFREMER, ORSTOM and UFP with the help of the Territory Department of Fisheries. Studies deal with the biology, physiology and ecology of the oyster and its environment.

A major problem in the Society Islands is the use of coral sand from the lagoon as a source of road building materials. A number of studies to investigate the damage this causes have been carried out (de Vaugelas 1979; Gabri  et al. 1985; Masson and Simon 1985; Porcher and Gabri  1985; Porcher and Gabri  1987).



Maria Tugaoen fish-feeding in Bora Bora.

Coral Reef Management, Recommendations and Legislation

Since 1984, the Territory has full power over environmental matters (law No. 84-820) of 6.9.84) and there is legislation for a certain number of ad hoc problems which are listed below:

Decision no. 88-183/AT of 8.12.88 prohibits the use of SCUBA equipment for spearfishing, of SCUBA for all fishing or collection of all marine animals, of certain toxic substances for fishing and defines the limits to the use of meshed nets.

Decision no. 88-184/AT of 8.12.88 protects some marine species (*Charonia tritonis*, *Cassia rufa* and *C. cornuta*, *Turbo marmoratus*, *Trochus niloticus*, *Tridacna maxima*, *Atrina vexillum* [giant mussel], *Scylla serrata*, *Lisiosquilla maculata*, mantis-shrimp, manta ray). Fishing is limited to certain areas and for limited periods each year with bag limits. In some areas, no fishing is allowed.

Decision no. 90-83/AT of 13.7.90 protects three species of marine turtles (*Chelonia mydas*, *Dermochelys coriacea* and *Eretmochelys imbricata*).

Decision no. 90-93/AT of 30.8.90 protects all "black coral" species (Cirripathes and Antipathes).

Until 1995, the Planning Code of French Polynesia allowed the classification of sites but without enforcement: 164 sites are classified as cultural heritage and 29 as natural heritage, but the Code is not adapted for protection of lagoonal environment (Hutchings et al. 1994).

In December 1995, the Territorial Assembly adopted the following International Conventions (Gabri  1995):

The Apia Convention (1976): to create protected areas (natural ecosystems, geological sites, cultural sites).

The PROE Convention (1986): for the prevention of pollution in the South Pacific and for the protection of rare and fragile ecosystems.

The Washington Convention: to protect the endangered species, *Tridacna maxima* (clam), *Antipatharia* sp. (black coral), *Scleractinia*, Milleporidae, Stylasteridae, marine turtles *Chelonia mydas*, *Dermochelys coriacea* and *Eretmochelys imbricata*, and cetaceans. Moreover, French Polynesia is a member of the Convention on International Trade in Endangered Species (CITES) of Wild Flora and Fauna which regulates the international commercial trade of hard and black corals (Callister 1995).

The Convention for the protection of cultural and natural worldwide heritage (Paris 1972).

The Convention of Bonn (1985): Protection of migratory species.

The Worldwide Convention for the Biodiversity (1992).

The Man and Biosphere Programme (UNESCO): creation of reserves of the Biosphere (as Taiaro Atoll).

There are currently several research and monitoring programmes. The Territorial Observation Network for the Marine Environment is pioneered by the Delegation of the Environment; the Network for the Monitoring of Swimming Beaches operates under the Ministry of Health. An environmental observatory has been planned for 1996 to compile data provided by research departments in the Territory. A research programme named "Anthropic" is conducted by ORSTOM to study anthropogenic pressures in the lagoon. The Delegation of the Environ-

ment works on the development of management plans. One of these plans is the Management Plan of Maritime Areas (MPMAs). The procedure outlining MPMAs is defined by a decision (no. 92-221) of the Territorial Assembly. The purpose of MPMAs is to determine the conditions of use, development, protection or enhancement of lagoons or maritime seabords (Serra et al. 1995). At this date, no MPMAs has been approved; however 10 geographical zones were selected as priorities for the 1994-98 period. The funding of the MPMAs is provided in part from territorial funds and in part from credits allocated as part of the 1994-98 Development Contract entered into between the French State and Territorial authorities. A detailed study of Bora-Bora was undertaken to establish a Marine Territorial Park but to date the park has not been declared (Hutchings et al. 1994).

An integrated Coastal Zone Management Plan for the entire region will lay down guidelines for coastal marine activities and exploitation of its resources (Gabri  1994). A public awareness-building action to preserve the natural heritage provided by lagoons has been undertaken by the Delegation of the Environment and the Department of the Sea.

Marine and terrestrial protected areas have been established.

Marine Protected Areas (about 0.1% of the total lagoonal area):

- Tuamotu group: Taiaro Atoll (W.A. Robinson Reserve Integrale); Biosphere Reserve (MAB Programme), 923 ha.
- Society Islands: Manuae (Scilly) and Bellinghausen (Motu One) Atolls; Territorial Reserve, 10,400 ha and 960 ha.
- Marquesas: Islet of Motu One

Terrestrial Protected Areas:

- Society Islands: Te Faaiti natural park (Tahiti, 750 ha)
- Marquesas: Islets of Mohotani (1,554 ha), Eiao (5,180 ha) and Hatutaa (1,813 ha).

The main problem is the lack of enforcement of these restrictions.

Future Trends and Conclusions

Lack of protection of coral reef environments is a problem in French Polynesia in spite of an existing database and access to highly qualified scientists and managers.

With a rapidly expanding population and attempts to increase tourism, the pressure on the reefs and the surrounding areas will only increase. Unless measures are taken to control fishing, water quality, restrict the discharge of untreated sewage and terrestrial runoff, the reefs will continue to decline. Urgent action is required by the Territorial Government to implement and enforce the management of coral reefs and lagoon environments, but currently their protection does not appear to be a priority. Hopefully this will change before it is too late.

Characteristics of the Main Islands

SOCIETY ISLANDS Characteristics

Bellinghausen (Motu One) Closed atoll with 4 islets; triangular reef.

Bora-Bora (Pora-Pora) 30 km², high volcanic (727 m); deep large lagoon with one pass; well developed reef islands on wide barrier reef; considered one of the most beautiful islands in the world.

Characteristics of the Main Islands (continued)

SOCIETY ISLANDS	Characteristics
Huahine Nui and Huahine Iti	73 km ² , twin volcanic islands (435 m and 669 m); surrounded by narrow barrier with five passes; barrier reef raised at north to form cultivated terrace; fringing reef around island largely dead.
Maiao (Tubuai-Manu)	9.5 km ² almost-atoll with volcanic ridge (154 m); 7 islets on barrier (Tapuaemanu) reef; ridge flanked by coral flats and barrier reef.
Maupiti	13.5 km ² , almost-atoll with small residual volcanic island (380 m) separated from a wide barrier reef flat by shallow, partially reticulated lagoon; barrier reef with well developed islands; central island flanked by well-developed fringing reef; considerable freshwater inflow; abundant reef life and lagoon fish fauna.
Mehetia (Mahetia, Meetia)	2 km ² , high volcanic (433 m), still active; youngest island in Societies situated close to a hot spot; no true fringing reefs but coral colonies found on submarine volcanic slopes, particularly <i>Pocillopora</i> .
Mopelia (Maupihaa, Mopihaa)	2.6 km ² , atoll with many islets; reef with narrow pass; coralline algal ridge; corals play very small role in reef formation.
Raiatea and Tahaa	194 km ² and 88 km ² , high volcanic (1,017 m and 590 m); barrier reef encircling both islands; lagoon continuous apart from two short sections on west and penetrates deeply into bays, becoming larger north of Tahaa.
Tetiaroa	1,288 ha, atoll with 13 islets around enclosed lagoon; 6 islets have seabird rookeries, including Tahuna Rahi and Tahuna Iti; privately owned with hotel.
Tupai (Motu Iti)	21 km ² , only atoll in Leeward Islands; barrier reef with two motu; narrow shallow closed lagoon with numerous coral patches and abundant phytoplankton; partly private.
TUAMOTU ISLANDS	
Morane	Atoll; enclosed lagoon, 3 islets.
Maria	Atoll; enclosed lagoon.
S. Marutea	Atoll; 18 km long with islets; 1 pass into lagoon.
Actaeon Group	
Matureivavao (Maturei Vavao)	Atoll, low, with enclosed lagoon.
Tenarunga	Atoll; low, with enclosed lagoon.
Vahanga	Atoll; low, with enclosed lagoon.
Tenararo (Tenaroa)	Atoll, low, with enclosed lagoon.
Fangataufa (nuclear testing site)	Oblong atoll; lagoon 40-42 m deep (10 km); 1 pass into lagoon; reefs consist of coralline edge, reef-flat, inshore belt.
Tematangi	Atoll; low, with enclosed lagoon.
Tureia	Atoll; low, with enclosed lagoon.
Vanavana	Atoll; narrow strip of land enclosing lagoon.
Nukutipi	Atoll; 4 km; enclosed lagoon; badly damaged by cyclones; privately owned; proposed for future studies.

Characteristics of the Main Islands (continued)

Duke of Gloucester Group Characteristics

Anuanurunga	Atoll; 4 islets on reef.
Anuanuraro	5 km enclosed lagoon; privately owned.
Hereheretue	Atoll; enclosed lagoon, molluscs studied on 2 reefs.
Reao	Narrow atoll and enclosed lagoon (22 x 4 km); molluscs studied on 5 reefs; densities of <i>T. maxima</i> ; 50-70/km ² over 370 ha of lagoon coast; <i>Porites mordax</i> and <i>Acropora formosa</i> very abundant in lagoon but coral diversity low.
Pukarua (Pukaruha)	Atoll; enclosed lagoon (13 x 3 km).
Tatakoto	Atoll; low with enclosed lagoon (15 x 6 km).
Pinaki	Atoll; 3 islets to north-west of reef.
Nukutavake	Coral island with no lagoon (5 x 2 km).
Vairaatea	2 islands; barrier reef.
Vahitahi	Long atoll with enclosed lagoon.
Akiaki	Small round island with enclosed lagoon.
Ahunui	Enclosed lagoon.
Paraoa	Enclosed lagoon; turtles.
Manuhangi	Enclosed lagoon.
Nengonengo	Nearly circular atoll; pearl-rich lagoon.
Hao (military site)	Atoll (56 x 15 km); 1 pass into lagoon; considerable research works.
Amanu	Atoll
Ravahere	Atoll; enclosed lagoon.
Marokau	
Reitoru	Atoll; enclosed lagoon.
Haraiki	
Hikueru	Atoll (12 km); no passes into lagoon.
Tekokota	Atoll; enclosed lagoon.
Tauere	
Rekareka (Rekareta)	Atoll; enclosed lagoon; no freshwater.
N. Marutea	Atoll; submerged barrier reef.
Nihiru	Circular atoll with enclosed circular lagoon.
Pukapuka	Atoll; enclosed, very shallow (less than 5 m) lagoon.
Fakahina (Fangahina)	Atoll
Fangatau (Angatau)	Atoll; enclosed lagoon (7 x 4 km)
Disappointment Group (Pukarua)	
Napuka	Irregularly shaped atoll; closed lagoon; narrow reef; study of fishing; proposed for future research.

Characteristics of the Main Islands (continued)

TUAMOTU ISLANDS	Characteristics
N. Tepoto	No lagoon but central depression, 1.6 km diameter; proposed for future research.
Takume	Atoll (23 x 7 km); 2 passes into lagoon.
Raroia	23.3 km ² , oval atoll with many islets around lagoon, 1.8 m deep.
Taenga	Southern reef awash.
Makemo	2 passes into lagoon.
Katiu	Atoll (24 x 13 km); low; 2 passes into lagoon.
Hiti	Atoll; enclosed lagoon.
Tuanake	Small boat entrance only to lagoon.
S. Tepoto (Eliza)	Atoll; small boat entrance only to lagoon.
Motutunga	Atoll
Tahanea	Atoll; 3 passes into lagoon.
Anaa	Atoll; 11 islets, with enclosed lagoon (30 x 10 km); 600 million individuals of <i>Cardium fragum</i> ; proposed for future research.
Faaite	Atoll
Fakarava (Fakareva)	Rectangular atoll with islets confined to east of lagoon (56 x 24 km); 2 passes into lagoon.
Raraka	Circular atoll
Kauehi (Kaueki)	Circular atoll
Aratika	Triangular atoll (37 x 24 km) with 2 passes into lagoon.
Toau (Toua)	Untouched by ciguatera poisoning.
Niau	Atoll (5 m); elliptical with completely enclosed lagoon; fringing reef.
Kaukura	Atoll; 2 narrow passes into lagoon (47 x 13 km).
Apataki	Atoll (30 x 24 km) with 3 passes into lagoon.
Arutua	Circular atoll (28 km); 1 pass into lagoon.
King George Islands	
Tikei	Small, low coral island (3 m); fringing reef.
Takaroa	Atoll (28 x 8 km); 1 pass into lagoon.
Manihi	Atoll; shoaly lagoon; coral diversity greatest near pass; <i>Leptoseris</i> and <i>Pachyseris</i> found only here.
Ahe	Atoll (24 x 9 km); 1 pass through lagoon.
Makatea	28 km ² (7 x 4.5 km); only raised atoll in French Polynesia, 113 m; terraced with central hollow; partly surrounded by fringing reef extending out 100 m from base of vertical cliffs which flank almost all coast; coral cover low; corals diverse on outer slopes only. Makatea was intensely mined for phosphate from 1917 to 1966; it was once the most populated island in the Tuamotu group but is now inhabited by only 30 copra workers.

Characteristics of the Main Islands (continued)

GAMBIER ISLANDS

Characteristics

- Temoe** (Timoe) 6.9 km²; low coral atoll (1.8 m) with lagoon (23 m max. depth) enclosed by reefs 91 m wide.
- Mangareva** 13 km²; high volcanic (445 m) fringing reef on exposed south coast, 150 m wide, sometimes discontinuous; well-developed reef on east south of Rikitea, near Teonekura and to northeast of village between Kureru and Teauouo; in Rikitea Bay, reefs are largely covered with sand; wide (100-500 m) reefs are found on the gentle slope, in very shallow water at low tide, on the north and west sides, mainly around headlands.
- Aukena** 13 km²; volcanic (198 m), reefs best developed (unusually) on more exposed southeast coast; fringing reef extends from Teanakoporo to Mata Kuiti, about 500 m wide with some rich coral and algal growth; on northwest small discontinuous reefs found.
- Akamaru** 18 km²; volcanic (246 m), few reefs due to exposure, always non-emergent.
- S. Lagoon Islets**
- Manui** Volcanic; reefs virtually absent.
- Kamaka** Volcanic; 176 m; few reefs.
- Makaroa** Volcanic; reefs virtually absent; visited for fishing.
- Tarauruoa** Volcanic; reefs virtually absent.
- Totegegie** Volcanic; reefs virtually absent.
- Motu-Teiko** Volcanic; reefs virtually absent.
- Taravai** 5.7 km²; volcanic (256 m); south coast exposed with only narrow reefs, sometimes discontinuous; east coast also exposed, reefs well developed only to north of village of Taravai; a reef also occurs in the shallow channel between this island and Agakauitai; discontinuous fringing reefs on west coast.
- Agakauitai** Volcanic, 146 m; reefs same distribution as those around Taravai.

MARQUESAS ISLANDS

- Motu One** (Hot de Sable) Cay situated on a volcanic plug, with no vegetation; consists of sand and its formation regularly changes; fringing reef; the only coral island in the Marquesas; to the east of the islet is a large stand of *Hydrolithon* (*Porolithon*) and calcareous algae considered unique in French Polynesia; *Chelonia mydas* nesting area.
- Hatutaa** (Hatutu) 1,813 ha (8 x 3 km); high volcanic (420 m); seabirds.
- Eiao** 52 km² (13 x 7 km); high volcanic (577 m); seabirds.
- Motu Iti** 3 low barren dry islets.
- Nuku Hiva** 330 km² (32 x 20 km); high volcanic (1,208 m); fringing reef in some bays; those at Taiohae, Tai-Oa, Controleur, Anaho, Hatiheu, and Haaopu; red tide recorded.
- Ua Huka** 77 km² (15 x 8 km); high volcanic (854 m); reefs in bays of Hane, Vaipae and Hatuana; islet (Motupapa) with seabirds.
- Ua Pou** 105 km² (15 x 10 km); high, volcanic (1,252 m); reefs in bays of Hakahetau, Hakanahi, Hakahau, Hohoi, Hakatao and Hakamaii; flat-topped islet (Motuoa) with seabirds.

Characteristics of the Main Islands (continued)

MARQUESAS ISLANDS Characteristics

Fatu Huku (Fatu Hutu)	1.3 km ² (4.5 x 0.8 km); dry rocky islet (359 m); seabird rookery.
Hiva Oa	320 km ² (35 x 13 km); high, volcanic (1,190 m); fringing reef in bays of Taaoa, Punahe, Hanamate, Puamau and Hanaiaapa.
Tahuata	50 km ² (15 x 9 km); high, volcanic (1,050 m); fringing reef in bays of Motopu, Hana Hevane, Hana de Toi, Vaitahu and Hapatoni; reefs most abundant at Hana Hevane and Motopu.
Mohotani (Motane, Mohotane)	15 km ² (8 x 2 km); (520 m); dry; seabirds.
Thomasset Reef (Ariane Rock)	Isolated rocky islet.
Fatu Hiva	80 km ² (15 x 7 km); high, volcanic (960 m); very few corals; reefs at Tataaihoa Point and Omoa Bay.

AUSTRAL ISLANDS

Marotiri (Bass Is)	0.26 km ² ; 9 volcanic rock pinnacles (105 m) without vegetation, including Marotiri Nui, Marotiri Iti and Vairiavai.
Raivavae (Raevavae)	16 km ² ; 9 km long, high volcanic (437 m); fringing reefs and almost continuous barrier reef and reef islets; lagoon fauna poorer than that of Gambiers, despite similar latitude; fauna of outer reefs similar.
Tubuai	48 km ² ; high volcanic (422 m); surrounded by barrier reef with 7 islets; rich coral fauna (77 species, including sp. not found elsewhere in Polynesia).
Rurutu	29 km ² ; high volcanic (389 m), some elevated reef limestone makatea.
Rimatara	Low (95 m), volcanic and makatea; fringing reef.
Maria (Hull)	1.3 km ² ; 4 islets, dense atoll forest triangular reef, shallow lagoon.

ACRONYMS

ADB: Asia Development Bank

CEP: Centre d'Expérimentation du Pacifique

CITES: Convention on International Trade in Endangered Species

CRIOBE: Centre de Recherches Insulaires et Océaniques en Biologie et Ecologie

EPHE: Ecole Pratique des Hautes Etudes

EVAAM: Etablissement de Valorisation des Activités Aquacoles et Maritimes

IFREMER: Institut Français de Recherche pour l'Exploitation de la Mer

IUCN: The World Conservation Union

MAB: Man and Biosphere

MNHN: Museum National d'Histoire Naturelle, Paris

MPMAs: Management Plan of Maritime Areas
 ORSTOM: Institut Français de Recherche Scientifique pour le Développement en
 Coopération
 PROE: Programme Régional Océanien de l'Environnement
 SMSRB (exSMCB): Service Mixte de Surveillance Radiologique et Biologique
 SPREP: South Pacific Region Environment Programme
 UFP: Université Française du Pacifique
 UNDP: United Nations Development Programme
 UNEP: United Nations Environment Programme
 UNESCO: United Nations Educational, Scientific and Cultural Organization
 WWF: World Wildlife Fund

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