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# CORAL AND FISH COMMUNITIES IN A DISTURBED ENVIRONMENT: PAPEETE HARBOR, TAHITI

BY

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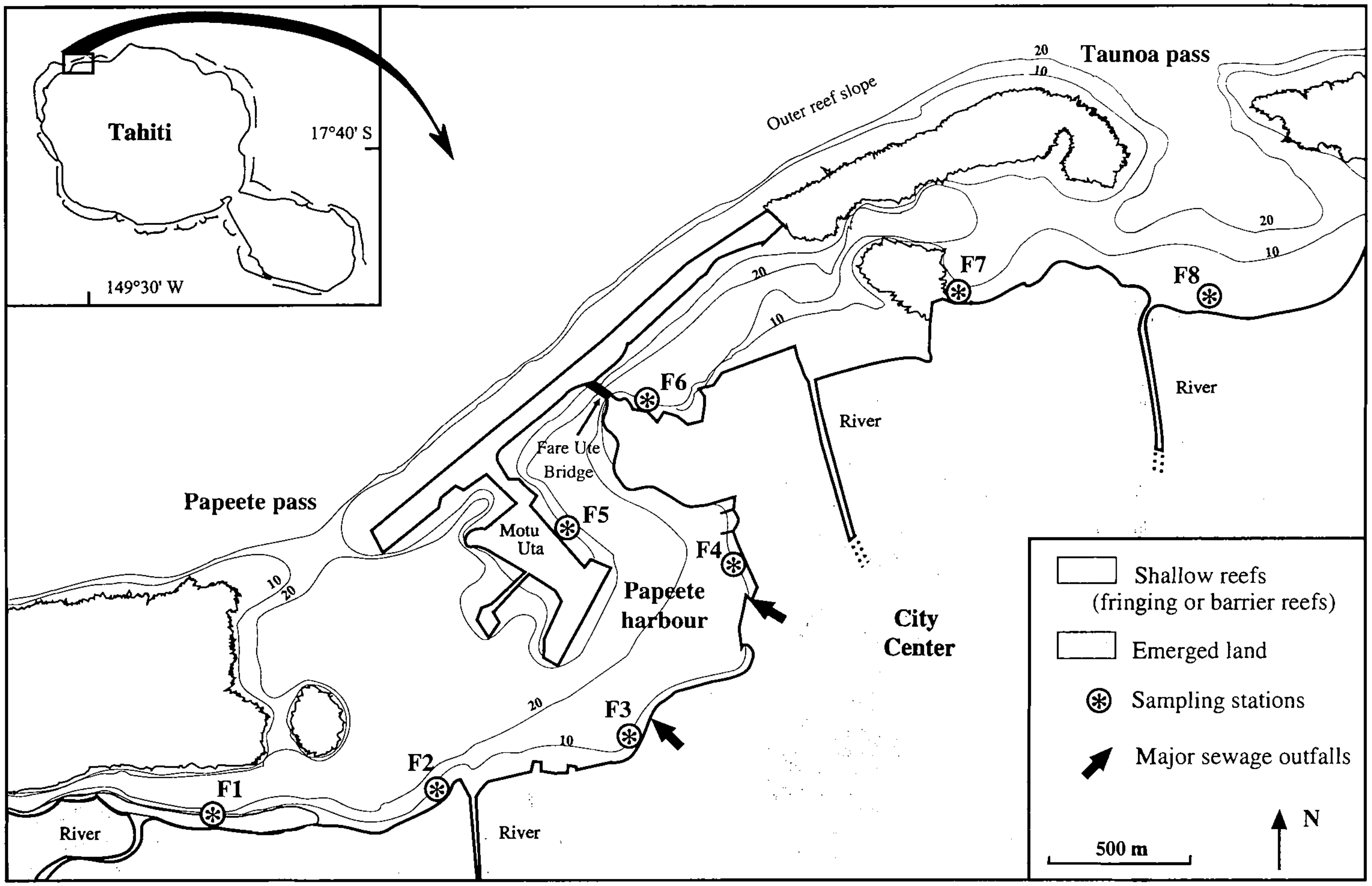


Figure 1. Map of the Papeete harbor vicinity; the eight sampling stations (F1 to F8) are indicated by asterisks.

# CORAL AND FISH COMMUNITIES IN A DISTURBED ENVIRONMENT: PAPEETE HARBOR, TAHITI

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MEHDI ADJEROUD[1], SERGE PLANES[1], and BRUNO DELESALLE[1]

## ABSTRACT

A total of 104 fish and 24 coral (Scleractinia, Zoanthidea, Corallimorpharia, Milleporina) species were identified in the area of Papeete harbor (Tahiti, French Polynesia). This overall richness is comparable to less-disturbed fringing reefs around high volcanic islands in the Society Archipelago. Human activities reduced species richness slightly in inner areas of the harbor. Two passes, which connect the harbor to the open ocean, renew lagoonal waters in the inner harbor at a rate that appears sufficient to minimize effects of human disturbance.

## INTRODUCTION

Reef communities are highly sensitive to a wide range of human-induced disturbances (Nishihira, 1987; van Woesik, 1994; and Green et al., 1997). Mining and dredging operations constitute one of the most obvious potential threats to reef communities (Dodge and Vaisnys, 1977; White, 1987; Brown et al., 1990; and Rogers, 1990). The impact of sediment disposal from dredging on reef communities varies according to factors such as the degree of resulting turbidity and the presence of toxic substances in dredged materials (Rogers, 1990). Nutrient enrichment by sewage effluent generally enhances benthic and planktonic algal biomass and primary production, which reduces coral abundance and favors benthic filter-feeding invertebrates (Pastorok and Bilyard, 1985; and Tomascik and Sander, 1987). Toxic effects, such as metabolic changes, decreased growth and reproduction (Pastorok and Bilyard, 1985), may result from chemicals commonly found in sewage effluent (metals, PCBs, chlorine, pesticides, and petroleum hydrocarbons). Although large discharges of effluent into poorly flushed lagoons and bays have caused major changes in reef community structure (Pastorok and Bilyard, 1985), little or no impact has been observed on some well-flushed reefs that received small quantities of effluent. While human-induced disturbances result in generally declining reefs in harbors, the construction of a harbor in Diego Garcia Atoll had no major or lasting effect on coral diversity or coral cover (Sheppard, 1980).

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In French Polynesia, spatial and temporal patterns of macrobenthic invertebrates and fish assemblages are well documented on fringing reefs, barrier reefs, and outer-reef slopes surrounding high volcanic islands (Galzin, 1987; Adjeroud, 1997; and Augustin et al., 1997). In contrast, reefs in harbor locations have been largely ignored. The aim of the present study was to examine the status of coral and fish communities in Papeete harbor.

## METHODS

With approximately 93,000 inhabitants, the city of Papeete and its suburbs are by far the most populated area in French Polynesia. Papeete harbor was built on both sides of a deep channel connecting Papeete pass and Taunoa pass (Fig. 1). The ocean side of the harbor was built by extension of a small islet (Motu Uta), and is connected to the island side by Fare Ute Bridge. The island side of the harbor is adjacent to the city center. In operation since the end of the 19$^{th}$ century, the harbor was subjected to extensive construction and development during the 1960's. This development persisted into the 1980's with total freight traffic increasing from 600,000 tons in 1977 to 1 million tons in 1987.

Eight stations were established in the study area (Fig. 1). Stations F3, F4, F5, and F6 were located in the inner part of the harbor, whereas stations F1, F2, F7 and F8 were located at its margin. A station was defined as an area of approximately 250 $m^2$ (10 25), starting from the shore down to a depth of 5 m. At each station, one qualitative survey (presence/absence) of fishes was made by Planes by snorkeling or diving during a 60-minute period of observation on the area covered by the station. The same method (i.e., 60-minute period of observation) was used by Adjeroud for the qualitative survey of anthozoans (including hard and soft corals and *Millepora*, herein classified as corals). Qualitative surveys were made in August 1995 (dry season). Surveys of surface-water quality characteristics at the same eight stations were made once a year at the beginning of the rainy season (November) from 1990 to 1995 by the Laboratoire d'Etudes et de Surveillance de l'Environnement (LESE). Temperature, salinity, pH, and dissolved oxygen were measured using *in situ* probes. Surface-water samples were collected for measurement of suspended matter, nutrients ($NH_4$, $NO_2$, $NO_3$, $PO_4$, $SiO_2$), and heavy metals (Fe, Cu, Zn). Additional details on water-survey methodologies are given in Langomazino et al. (1993).

Classification analysis (CA) was used to examine the variation in species composition among stations.

## RESULTS

### Fish and coral communities

A total of 104 fish species representing 25 families was recorded at the eight stations (Table 1). Dominant families were Labridae (20 species), Pomacentridae (16 species), Acanthuridae (13 species), and Chaetodontidae (12 species). Species richness varied from 28 to 51 species per station. The lowest species richness was found in the inner part of the harbor (stations F4 and F6). Highest species richness was found at stations F1, F2, and F8 located at the margin of the harbor. Seven species were observed stations F1, F2, and F8 located at the margin of the harbor. Seven species were observed at all eight stations, whereas 32 species were each observed at only one station. Classification analysis showed that F8 and F3 had a distinct species composition with several species not observed elsewhere in the harbor. Species composition at other stations was more similar, particularly at F5, F6, and F7 (Fig. 2).

A total of 24 coral species representing four orders (Scleractinia, Zoanthidea, Corallimorpharia, Milleporina) was recorded during this survey (Table 2). Species richness varied between 8 and 15 species per station. As with fishes, the highest species richness was found at the margin of the harbor (stations F1, F6, F7, and F8). Two species were observed at all eight stations and five species were each restricted to one station. Because they were mainly composed of common species, species assemblages at stations F2, F5, F7, and F8 were highly similar (Fig. 2). In contrast, stations F1 and F6, which contained several species not observed elsewhere in the harbor, had distinct species compositions.

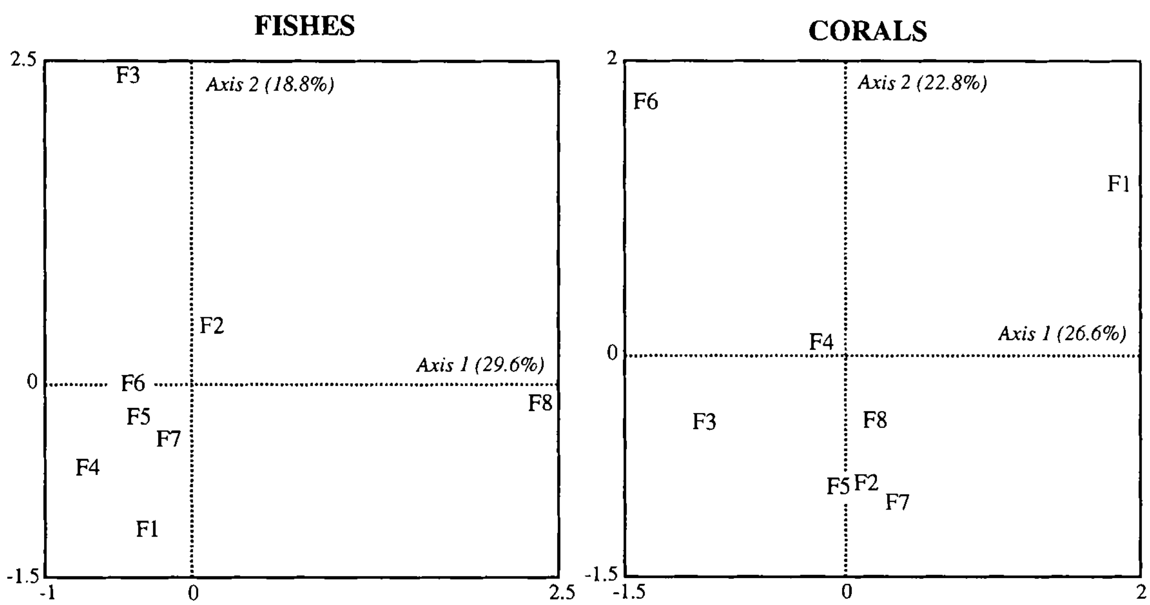


Figure 2. First two axes of the classification analysis performed on coral and fish species composition recorded at the eight stations. The inertia of each axis is given.

Water quality survey

Mean values of temperature, pH, $NO_2$, suspended matter, and Cu concentrations were quite similar among stations (Table 3). Dissolved oxygen concentrations were also similar among stations except for station F3 where the mean value was slightly higher.

Stations F3 and F7 were characterized by lower salinities and higher concentrations of $SiO_2$, indicating that these stations were subjected to higher terrestrial influences. Stations F3 and F7 were also characterized by high $NO_2$, $NH_4$ and $PO_4$, and Fe concentrations.

## DISCUSSION

With 104 fish species and 24 coral species identified, the overall richness in the area of Papeete harbor is not dramatically different when compared with less-disturbed fringing reefs surrounding high volcanic islands in the Society Archipelago. In Moorea, 24 coral and 141 fish species were recorded on the lagoonal fringing reefs surrounding the island, and 33 coral and 112 fish species were observed on the fringing reefs bordering Opunohu Bay on the north coast of the island (Galzin, 1987; Adjeroud, 1997; and Planes, unpubl. data). Variation in species composition of coral and fish assemblages within Papeete harbor was moderate. Dissimilarities among stations were caused mainly by the addition of several occasional species (i.e., observed at one or two stations), but not by a substitution of species. Moreover, most of the species observed within the harbor are commonly found on fringing and barrier reefs around high volcanic islands in the Society Archipelago. Thus, no particular species, such as introduced species imported by transoceanic shipping (Carlton, 1987), were found in Papeete harbor, nor were any possible "indicator" species missing from inner-harbor stations.

Despite a reduction in the number of species observed in the inner part of Papeete harbor where human activities are concentrated, a minimum of 28 fish and 8 coral species was found. We may conclude that harbor and human activities in Papeete induced only a slight reduction in species richness; this reduction was restricted to the inner part of the harbor as was also observed in Castle Harbor, Bermuda (Dodge and Vaisnys, 1977). We suspect that the weak and localized impact of harbor and human activities is a function of water circulation in the area. Water enters the lagoon primarily by Papeete Pass and exits by Taunoa Pass resulting in an eastward current (De Nardi et al., 1983). A reverse tide-phase current is sometimes observed, mainly during the dry season (May to September). The mean current speed at Fare Ute Bridge was estimated at $0.35\ m.s^{-1}$ during the wet season, but can exceed $1.00\ m.s^{-1}$ under strong winds (De Nardi et al., 1983). These currents drove a flow estimated as $200\text{-}600\ m^3.s^{-1}$. From these flow estimations, it can be deduced that the entire volume of the inner part of the harbor is renewed in 4 to 12 hours. This hydrodynamic pattern seems sufficient to prevent confinement of waters to the inner part of the harbor, which may alleviate any resulting harsh hydrological conditions that might develop given the nature and extent of human activities.

The number of fish and coral species per station was not significantly correlated with any of the hydrological factors selected in this study (Pearson correlation coefficient, $p>0.05$). The rapid renewal of lagoonal waters may help explain why the hydrological factors considered here had rather weak explanatory power. In fact, the mean values of several factors (salinity for example) did not reach extreme values such as those that are associated with a reduction in number of species in bayheads of Moorea (Adjeroud, 1997). Other factors did not vary significantly among stations as was also shown by Langomazino et al. (1993). The variation in species composition and richness in Papeete harbor that we did find is likely due to other unmeasured environmental factors, such as extent of adequate substrate and habitat for recruitment, nature and level of sedimentation, and biotic interactions. Additional measurements of abiotic factors in the water column and in the substrate therefore are needed to allow us to identify more clearly possible factors influencing the distribution of species in this area.

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Table 1. Fish species recorded at the eight stations in Papeete harbor. The location of the stations is presented in Fig. 1.

| Species | Stations | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | F1 | F2 | F3 | F4 | F5 | F6 | F7 | F8 |
| *Saurida gracilis* | | | | | | | | + |
| *Myripristis* sp. | + | + | | + | + | + | + | |
| *Neoniphon aurolineatus* | + | | | | | | | |
| *N. sammara* | + | | | + | + | | | |
| *Aulostomus chinensis* | + | + | | + | | + | | |
| *Fistularia commersonii* | | | + | | | | | |
| *Pterois radiata* | | | | | | | + | + |
| *Cephalopholis argus* | + | | | | | | | |
| *Epinephelus merra* | + | + | + | + | + | + | + | + |
| *Cirrhitus pinnulatus* | | | | | | | | + |
| *Paracirrhites arcatus* | | | | | | | | + |
| *Apogon fraenatus* | | | + | | | | | |
| *A. kallopterus* | | | | | + | | + | |
| *A.* sp. | | | | | | | + | |
| *Cheilodipterus quinquelineatus* | | | + | | + | + | | |
| *Caranx melampygus* | | + | + | | | | | |
| *C. sexfasciatus* | | | | + | | + | + | |
| *Lutjanus fulvus* | + | + | + | + | + | + | | |
| *Caesio caerulaurea* | + | + | + | | + | | + | |
| *Gnathodentex aureolineatus* | + | | + | | | + | + | |
| *Monotaxis grandoculis* | | + | + | + | + | + | | |
| *Mulloides flavolineatus* | | | + | | | | | |
| *M. vanicolensis* | | | + | | | | | |
| *Parupeneus barberinus* | + | + | | + | + | + | + | |
| *P. ciliatus* | + | + | | + | | | | |
| *P. multifasciatus* | + | + | + | | + | + | + | + |
| *Chaetodon auriga* | | | | + | | | + | |
| *C. citrinellus* | + | | | + | | + | | |
| *C. decussatus* | + | | | + | + | + | + | |
| *C. flavirostris* | + | + | | | | | + | + |
| *C. lunnutatus* | + | + | | + | | | + | |
| *C. lunula* | | | | | | | | + |
| *C. ornatissimus* | + | + | + | + | + | + | + | + |
| *C. reticulatus* | | | | | | + | | |
| *C. ulietensis* | + | + | + | + | + | + | + | + |
| *C. unimaculatus* | + | | | | | | | |
| *Forcipiger flavissimus* | + | + | + | | + | | + | + |
| *Heniochus chrysostomus* | | + | + | | | + | | |
| *Centropyge flavissimus* | + | + | + | + | + | + | | |
| *Abudefduf septemfasciatus* | | + | + | | + | | + | |
| *A. sexfasciatus* | + | | | | + | | + | + |
| *A. sordidus* | + | | | | | | | |
| *Chromis iomelas* | | | | | | | | + |
| *C. margaritifer* | | | | | | | | + |
| *C. vanderbilti* | + | | + | | + | | + | |
| *C. viridis* | | + | | | | | | + |
| *Chrysiptera leucopoma* | + | | + | + | + | + | | |
| *Dascyllus aruanus* | + | | | | + | | | + |
| *D. trimaculatus* | | | | | | | | + |
| *Plectroglyphidodon leucozona* | + | | + | + | + | + | + | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| *Pomacentrus pavo* | | + | + | | | + | + | + |
| *Stegastes albofasciatus* | | + | | | | | | |
| *S. fasciolatus* | | | | | | | | + |
| *S. lividus* | + | + | + | + | + | + | + | |
| *S. nigricans* | | + | | | | | | |
| *Anampses caeruleopunctatus* | | | | | | | | + |
| *Bodianus axillaris* | | + | + | | | | | |
| *Cheilinus chlorourus* | + | | + | | | | | |
| *C. trilobatus* | + | + | | + | | | | |
| *Epibulus insidiator* | + | | | | | | | + |
| *Gomphosus varius* | | + | | | | | | + |
| *Halichoeres hortulanus* | | + | | | | | | + |
| *H. margaritaceus* | | + | + | | | + | | + |
| *H. marginatus* | | | | | | | | + |
| *H. ornatissimus* | | | | | + | + | + | |
| *H. trimaculatus* | + | + | | | | | | + |
| *Labroides bicolor* | + | + | | | | | + | + |
| *L. dimidiatus* | | | | | | | | + |
| *Pseudocheilinus hexataenia* | | + | + | | + | + | + | + |
| *Stethojulis bandanensis* | + | + | + | | | + | + | + |
| *Thalassoma hardwicke* | | | | | | | | + |
| *T. lutescens* | | + | | | | | | + |
| *T. purpureum* | | | | | | | | + |
| *T. quinquevittantum* | | | | | | | | + |
| *T. trilobatum* | | | | | | + | | |
| *Scarus brevifilis* | + | | | | | + | | |
| *S. oviceps* | + | + | | | + | + | + | + |
| *S. psittacus* | + | + | | | | + | + | + |
| *S. sordidus* | + | + | + | + | + | + | + | + |
| *Zanclus cornutus* | | | + | | | + | | + |
| *Acanthurus lineatus* | | + | + | | + | | | |
| *A. mata* | + | + | + | + | | | + | |
| *A. nigricauda* | | | | | + | | + | |
| *A. nigrofuscus* | | + | | | + | + | + | + |
| *A. nigroris* | + | | | | | | | |
| *A. olivaceus* | | | + | | + | | + | + |
| *A. triostegus* | | | + | | | | | |
| *A. xanthopterus* | + | + | + | + | + | + | + | + |
| *Ctenochaetus striatus* | + | | | | + | | + | |
| *Naso lituratus* | + | + | | | | | + | |
| *N. unicornis* | + | + | | + | + | + | + | + |
| *Zebrasoma scopas* | + | | | + | | + | | |
| *Z. veliferum* | | | | | + | | | |
| *Siganus spinus* | + | + | + | | + | | + | + |
| *Balistapus undulatus* | + | | | | + | | + | + |
| *Balistoides viridescens* | | | + | | | | | |
| *Rhinecanthus aculeatus* | | + | + | + | | | + | |
| *Sufflamen bursa* | | + | | | + | | | |
| *Ostracion cubicus* | + | | | | + | | | |
| *O. meleagris* | + | + | + | + | + | + | + | + |
| *Canthigaster janthinoptera* | | | | | | | | + |
| *C. solandri* | + | + | + | + | + | + | + | + |
| *C. valentini* | | | | | + | | + | |
| *Diodon hystrix* | + | | | | | | | |
| Species richness | 51 | 47 | 40 | 28 | 41 | 37 | 44 | 47 |

Table 2. Coral species recorded at the eight stations in Papeete harbour.

| | Stations | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Species | F1 | F2 | F3 | F4 | F5 | F6 | F7 | F8 |
| Scleractinia | | | | | | | | |
| *Psammocora contigua* | + | | | | | | | + |
| *P. profundacella* | | + | + | | + | + | | + |
| *Stylocoeniella armata* | | | | | | + | | |
| *Pocillopora damicornis* | + | + | + | + | + | + | + | + |
| *P. verrucosa* | + | + | + | | + | + | + | + |
| *Acropora valida* | + | + | | + | | + | + | + |
| *A.* sp. | | | | + | | + | | |
| *Montipora spumosa* | + | | | + | + | | + | + |
| *Montipora* sp. | | | + | | | + | | |
| *Pavona cactus* | + | | | + | + | + | + | |
| *P. varians* | | | | + | + | | | |
| *Fungia concinna* | | | + | | | + | + | + |
| *Herpolitha limax* | | | | | | | + | |
| *Porites rus* | + | + | + | + | + | + | + | + |
| *P. lutea* | + | + | + | + | + | | + | + |
| *P. lobata* | + | | | | | + | | |
| *Montastrea curta* | | | | | | + | | + |
| *Leptastrea transversa* | + | + | + | | + | | + | + |
| *Cyphastrea microphthalma* | | | | | | | + | + |
| *Acanthastrea echinata* | + | | | | | | | |
| *Lobophyllia hemprichii* | + | | | | | | | |
| Zoanthidea | | | | | | | | |
| *Palythoa* sp. | + | + | | | | | + | + |
| Corallimorpharia | | | | | | | | |
| *Rhodactis* sp. | + | | | + | | + | + | + |
| Milleporina | | | | | | | | |
| *Millepora platyphylla* | + | | | | | | | |
| Species richness | 15 | 8 | 8 | 9 | 9 | 13 | 13 | 14 |

Table 3. Hydrological characters of surface water measured at eight stations in the area of Papeete harbor. Values represent mean of annual surveys made from 1990 to 1995. Standard deviation in italics. Range (maximal and minimal values) in brackets.

| | Stations | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | F1 | F2 | F3 | F4 | F5 | F6 | F7 | F8 |
| Temperature (°C) | 28.42 | 28.12 | 28.45 | 28.70 | 28.25 | 28.32 | 28.15 | 28.27 |
| | *0.61* | *0.63* | *0.96* | *1.01* | *0.50* | *0.47* | *0.62* | *0.26* |
| | (27.8-29.0) | (27.5-29.0) | (28.0-29.2) | (27.8-30.0) | (28.0-29.0) | (28.0-29.0) | (27.5-29.0) | (28.0-28.5) |
| Salinity (psu) | 34.72 | 31.97 | 28.34 | 34.50 | 35.54 | 35.09 | 30.09 | 35.04 |
| | *1.27* | *1.26* | *0.04* | *0.86* | *0.19* | *0.31* | *1.05* | *0.13* |
| | (33.8-35.6) | (29.7-34.3) | (22.4-34.3) | (33.9-35.1) | (34.4-34.7) | (34.9-35.3) | (25.1-35.1) | (34.9-35.1) |
| pH | 8.12 | 8.15 | 8.17 | 8.17 | 7.96 | 8.14 | 7.98 | 8.11 |
| | *0.21* | *0.17* | *0.37* | *0.31* | *0.57* | *0.29* | *0.32* | *0.34* |
| | (7.8-8.2) | (7.9-8.3) | (7.8-8.5) | (7.7-8.4) | (7.1-8.3) | (7.7-8.3) | (7.5-8.2) | (7.6-8.3) |
| Suspended matter ($mg.l^{-1}$) | 4.19 | 3.37 | 3.20 | 3.10 | 1.91 | 4.01 | 3.48 | 2.27 |
| | *2.53* | *2.55* | *1.66* | *0.66* | *1.81* | *2.83* | *1.12* | *0.98* |
| | (1.6-6.7) | (1.0-6.7) | (1.9-5.6) | (2.5-3.7) | (0.4-4.5) | (1.4-7.8) | (2.3-3.3) | (1.0-3.3) |
| Dissolved oxygen (ppm) | 6.40 | 6.60 | 7.20 | 6.70 | 6.97 | 6.88 | 6.53 | 6.87 |
| | *0.55* | *0.70* | *0.50* | *1.55* | *1.77* | *1.31* | *1.69* | *1.36* |
| | (5.9-7.0) | (6.1-7.4) | (6.2-8.4) | (5.8-8.5) | (5.7-9.0) | (6.0-8.4) | (5.1-8.4) | (5.8-8.4) |
| $NH_4$ ($\mu mol.l^{-1}$) | 0.98 | 1.12 | 28.21 | 1.18 | 2.25 | 1.20 | 3.38 | 1.33 |
| | *1.17* | *0.12* | *5.13* | *0.67* | *0.72* | *0.70* | *1.06* | *0.63* |
| | (0.1-2.3) | (1.0-1.2) | (17.1-50.0) | (0.8-2.0) | (1.5-3.0) | (0.4-1.8) | (2.7-4.6) | (0.6-1.8) |
| $NO_2$ ($\mu mol.l^{-1}$) | 0.49 | 0.51 | 0.84 | 0.55 | 0.25 | 0.35 | 0.61 | 0.35 |
| | *0.52* | *0.67* | *0.67* | *0.83* | *0.19* | *0.50* | *0.86* | *0.50* |
| | (0.1-1.2) | (0.1-1.5) | (0.3-2.1) | (0.1-1.8) | (0.1-0.5) | (0.1-1.1) | (0.1-1.9) | (0.1-1.1) |
| $NO_3$ ($\mu mol.l^{-1}$) | 1.32 | 1.37 | 1.82 | 0.66 | 1.61 | 1.51 | 1.19 | 2.47 |
| | *1.70* | *1.09* | *0.42* | *0.59* | *0.63* | *1.07* | *0.83* | *2.62* |
| | (0.0-3.8) | (0.6-2.1) | (1.2-3.0) | (0.1-1.2) | (1.1-2.5) | (0.7-3.1) | (0.1-2.1) | (0.8-6.4) |
| $PO_4$ ($\mu mol.l^{-1}$) | 0.79 | 1.94 | 1.51 | 0.50 | 0.38 | 0.31 | 2.32 | 0.34 |
| | *1.20* | *3.08* | *3.11* | *0.43* | *0.54* | *0.33* | *3.52* | *0.52* |
| | (0.1-2.6) | (0.1-5.5) | (1.1-2.0) | (0.3-1.0) | (0.1-1.2) | (0.1-0.8) | (0.5-7.6) | (0.1-1.2) |
| $SiO_2$ ($\mu mol.l^{-1}$) | 20.52 | 8.95 | 30.69 | 3.60 | 6.77 | 2.06 | 28.20 | 7.86 |
| | *20.25* | *7.10* | *5.12* | *2.59* | *4.97* | *1.70* | *27.99* | *9.98* |
| | (1.6-51.5) | (1.3-18.0) | (2.1-98.6) | (0.6-6.0) | (1.4-11.2) | (0.5-2.6) | (2.3-67.4) | (0.5-22.5) |
| Fe ($\mu g.l^{-1}$) | 21.85 | 86.00 | 101.00 | 47.75 | 21.25 | 25.25 | 133.25 | 30.75 |
| | *10.73* | *54.25* | *47.48* | *31.74* | *12.12* | *18.78* | *85.13* | *28.93* |
| | (6.5-30.9) | (39.0-150.0) | (61.0-165.0) | (19.0-93.0) | (13.0-39.0) | (12.0-53.0) | (29.0-237.0) | (1.0-62.0) |
| Cu ($\mu g.l^{-1}$) | 1.57 | 1.87 | 1.90 | 1.70 | 1.30 | 0.85 | 1.65 | 1.15 |
| | *1.50* | *1.03* | *0.63* | *0.47* | *0.60* | *0.19* | *0.66* | *0.92* |
| | (0.5-3.8) | (1.0-3.0) | (1.2-2.4) | (1.0-2.0) | (1.0-2.2) | (0.6-1.0) | (1.0-2.4) | (0.5-2.5) |
| Zn ($\mu g.l^{-1}$) | 7.52 | 15.82 | 5.51 | 13.65 | 10.25 | 10.90 | 23.12 | 6.72 |
| | *5.23* | *21.04* | *10.02* | *13.29* | *3.78* | *8.41* | *24.95* | *7.95* |
| | (3.6-15.2) | (2.0-47.0) | (2.3-14.8) | (2.0-31.0) | (6.7-14.0) | (2.8-22.0) | (4.8-60.0) | (0.2-17.9) |