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A FIELD GUIDE TO THE REEFS OF CARIBBEAN PANAMÁ WITH AN EMPHASIS ON WESTERN SAN BLAS

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INTRODUCTION

Diverse and often spectacular coral reef communities dominate much of Panama's Caribbean coastline. This field guide aims to define and organize this diversity for participants of the 8th International Coral Reef Symposium (ICRS). It focuses on the relatively well studied coral reefs in the western San Blas region of Panama, the site of a Smithsonian Tropical Research Institute (STRI) field station, and the venue for ICRS field trips to Caribbean Panama. A brief description of reefs in northwestern Panama, near Bocas del Toro, is included.

This guide begins with a general overview of Panama's Caribbean reefs including geologic history, oceanographic conditions, and climate. Regional descriptions of the northeast and northwest coasts follow, with comments on current reef status and on human impacts. Specifics of the field trips come next, including a schedule and description of each venue. Information on the local fauna and flora concludes the guide in a series of tables providing general information on habitat distribution and abundance. We hope this information will not only serve participants in the field trips, but will also encourage researchers from abroad to develop and enact future projects in the region.

OVERVIEW

Geologic history

The Central American Isthmus fused to completion 3-3.5 million years ago, ending several millennia of flux between Atlantic and Pacific waters. Now known as Panama, this last continental sliver emerged from the complex tectonic convergence of the northeastward moving Cocos Plate, the eastward moving Nazca and Caribbean Plates, and the westward trending South American Plate. The geology of Panama reflects the complex history of the region, with recent volcanic rocks, ancient marine sediments, and the refuse of past subduction events lying juxtaposed along its 600 km northern coastline [Fig. 1A, see Coates and Obando (1996) for details].

Although periodic rises in sea level associated with global warming possibly breached the isthmus in later years (Coates and Obando 1996), the connecting of the Americas was an event with profound oceanographic and biogeographic consequences. With circumtropical flow effectively blocked and new gyres forming in both Pacific and Atlantic oceans, Caribbean waters became increasingly isolated. This eventually gave rise to a unique and distinctive regional flora and fauna. Today several thousand endemic species of fish, algae, corals, and other marine invertebrates thrive in Caribbean and tropical western Atlantic waters. Within the tropical western Atlantic, subregional endemism is not particularly common, probably because of its relatively small size. Many species, however, do not occur throughout the entire basin, producing geographically distinctive blends of flora and fauna. In this regard, Panama's reef communities reflect rather typical levels of biotic diversity and abundance.

Oceanography

Panama's northern coast (~ 9 °N; 79-81 °W) forms an elongate, east-west oriented "S" tucked between the rest of Central America and northern South America. The Main Caribbean Current streams well offshore; however, its strong westward flow may generate one to two large eddies that circulate along the coast (Fig 1). The extent to which these currents limit the dispersal of reef-produced propagules is not known. Upwelling does not occur along the Caribbean coast of Panama, but river runoff may seasonally enrich nearshore waters with nutrients. Unlike more than 90% of

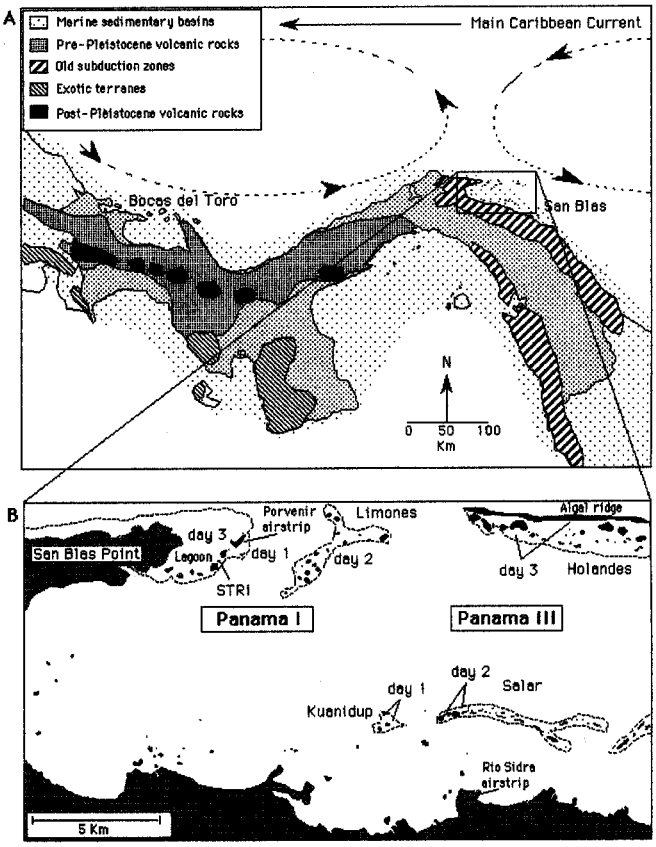

Fig 1: **A:** Map of Panama with geologic structure and nearshore currents (diagrams of water flow are schematic approximations and not drawn to scale; adapted from Coates and Obando 1996 and Lessios et. al 1984). **B:** Major reefs of western San Blas with associated field trip venues. Reef complexes outlined with dashed lines.

the tropical western Atlantic, Panama's coast generally escapes cataclysmic storms. Since hurricane records were begun 120 years ago (Newmann et al. 1981), a single hurricane ("Joan" in 1988) has brushed Panama's northwestern coastline.

Climate

Panama annually undergoes distinct periods of rain and drought (Cubit et al. 1989). The wet season (May-December) produces light and variable winds, mild currents, and periodic heavy rains that can result in substantial runoff onto nearshore reefs. Average air temperature (28° C), humidity (87%), sea temperature (mean =28° C, range = 26-32° C), and salinity (33-35 ppt) are characteristically tropical. Intense, but very brief, local squalls (gusts to 120 $km \cdot h^{-1}$) intermittently sweep along the northeastern coast during the wet season with no apparent ecological effects upon reefs.

Rainfall effectively stops during the dry season (January-April), characterized by consistently strong (30-40 $km \cdot h^{-1}$), northerly winds that can produce heavy surf, currents, and turbid water on all but the most protected leeward reefs. Solar radiation is generally higher during this time of year, and the water is more saline (Cubit et al. 1989). These seasonal changes can have important consequences for the life history of reef organisms in the region (e.g. Clifton 1995). While this annual cycle of rainfall and drought is

generally consistent from year to year, episodes of rain during the dry season and weeks without rain during the wet season are not uncommon.

RESEARCH IN PANAMA

The Smithsonian Tropical Research Institute has been the leading research organization in Panama for decades. Marine studies began at STRI in the 1960's and today the institute maintains active terrestrial and marine science programs along both sides of the isthmus and in the Panama Canal watershed, as well as elsewhere in Central America and abroad. A range of modern facilities and laboratories are available to staff and visitors, including several fully equipped molecular labs, scanning electron microscope, full SCUBA diving services, and an excellent scientific library. Marine laboratories are located at Naos island, near Panama City on the Pacific coast, and at Galeta Island on the Caribbean coast. The marine field station in San Blas provides basic accommodations and easy access to coral reefs. With appropriate association and planning, STRI can advise or help obtain the necessary documents for living and working in Panama, importing scientific equipment, and exporting specimens. Contact the Visitor's Service Office for further information. For inquiries regarding funding opportunities through STRI, contact the Office of Education and Grants. Key contacts at STRI regarding marine organisms include: Fishes: D.R. Robertson; corals: H. Guzman; echinoderms and other marine invertebrates: H.A. Lessios; marine algae: L. Hillis.

EASTERN AND WESTERN REGIONS OF CARIBBEAN PANAMA

San Blas

The eastern third of Panama's Caribbean coast, known as San Blas or Kuna Yala, comprises over 225 km of mangrove-lined coastline and an archipelago of several hundred small, nearshore sand cays stretching to the Colombian border. Extensive networks of coral reefs and seagrass meadows dominate shallow water regions along the narrow (< 17 km wide) continental shelf. Although agriculture may historically have altered the coastal mainland, today the region is almost entirely forested, save for the localized, subsistence-level, clear-and-burn agriculture of the Kuna Indians. This indigenous group controls San Blas as an autonomous political region within the Republic of Panama (formally recognized as a territorial reserve in 1938).

From mainland populations scattered throughout eastern Panama and northern Columbia, the Kuna began moving to nearshore islands around 1900. Today, as then, the demands of farming and access to natural resources, such as fresh water and firewood, constrain villages to the islands closest to shore. Noted for a highly organized, communal life-style, the Kuna govern the use of terrestrial and marine resources in the region, and their autonomy is an important component of conservation within the area. Their traditional life-style and native dress, particularly the colorful "mola" blouses worn by women, attract thousands of tourists and collectors to the region each year [see Howe (1986) and Ventocilla *et. al* (1995) for further information about the Kuna].

While San Blas remains relatively undeveloped, Kuna activities nonetheless affect the ecology of reefs, particularly around the 41 islands that contain villages. An average village is home to 300-500 people, although there are several larger "towns" of up to 5,000. Virtually all waste is discarded directly into the water, but sewage effects (at least near San Blas Point) are apparently minimal due to rapid dilution and dispersal. The population (currently about 45,000) has grown dramatically in recent years, and space at most villages is limited. Rather than developing new villages on other islands, Kuna often enlarge existing islands by building over shallow reef flat using coral, coralline rock, and seagrass sod as landfill. This results in the destruction of shallow (< 2 m depth) coral reef communities within 1-2 km of heavily populated islands.

In addition to traditional, subsistence-level fishing by hand line, commercial harvest of lobster (*Panulirus argus*), conch (*Strombus gigas*), spider crabs (*Mithrax spinulosa*), and octopus (*Octopus* spp) by Kuna skin divers is widespread. The few regulations enacted by the Kuna General Congress to govern the harvest of these resources are currently unenforced. Adults (and often juveniles) of exploited species are uncommon even at remote locations. Groupers (Serranidae), snappers (Lutjanidae), spotted spiny lobsters (*Panulirus guttatus*), and sea turtles are also taken for export, but less often. Seine nets are becoming increasingly popular for the capture of nearshore schooling fish, such as jacks (Carangidae) and tuna (Scombridae), while gill nets and fish traps are also employed but less frequently and with rather limited success. The overall effects of these techniques upon reef ecology in San Blas are not known; however, many larger, reef-based fish that are absent from heavily fished reefs in other regions of the Caribbean [e.g. Jamaica (Munro et. al 1987)], can still be regularly observed in San Blas.

In addition to human impacts, several other noteworthy ecological events have recently occurred in San Blas. As in all parts of the Caribbean, the black sea urchin, *Diadema antillarum*, suffered unprecedented mass mortality in 1983 [95 % of the population, (Lessios et al. 1984)], and the effects of its absence have been noted in the region (Robertson 1991, Shulman and Robertson in press). As of 1996, *Diadema* remain uncommon in San Blas, although local concentrations of these gregarious urchins do occur. Two major episodes of coral bleaching have also hit the region (1983 and 1995) affecting species to depths greater than 20 meters. While the 1983 event killed many corals, particularly *Agaricia* spp. and *Montastraea annularis* (Lasker et al. 1984), bleaching in 1995 was generally not lethal.

Most reefs in San Blas support diverse communities of corals (Table 1), fishes (Table 2) and other reef creatures (Table 3). Fifty seven species of scleractinian coral and four hydrocorals occur in the region (Holst and Guzman 1993). The pillar coral *Dendrogyra cylindrus*, a conspicuous reef builder elsewhere in the Caribbean, is notably absent. In leeward regions, shallow reef zones (< 10 m) are dominated by species of *Acropora*, *Agaricia*, *Porites*, and *Millepora*, with occasional massive corals such as *Colpophylia natans*, *Montastraea annularis* and *Diploria* spp. Smaller species such as *Favia fragum*, *Isophyllia rigida*, *Manicina areolata*, and *Siderastrea siderea* also are common. Reefs exposed to swells are less rugose and often dominated by the crustose coralline alga *Porolithon pachydermum*, itself a major reef builder. Deeper reefs (10-25 m) typically feature large colonies of *Montastraea faveolata*, *M. franksi*, and *M. cavernosa*, as well as many large "brain" corals and smaller corals such as *Mycetophyllia lamarckiana*, *Mussa angulosa*, and *Scolymia* spp. Extensive cover of *Agaricia tenuifolia* occurs on some deep leeward reefs. *Eusmilia fastigiata*, *Madracis mirabilis*, and *Porites astreoides*, occur at various depths. Reef growth in San Blas rarely extends below 20-30 meters (probably because of reduced nearshore water clarity), giving way to expanses of calcareous sediments (often derived from algae such as *Halimeda* spp.), silt, and mud rich in organic material. Robertson and Glynn (1977) profiled a variety of reefs in western San Blas for the 3rd Internaltional Coral Reef Symposium.

Gorgonian corals (subclass Octocorallia) also abound in San Blas, particularly those of the genus *Plexaura* and *Pseudoplexaura* (Table 1). *Plexaura kuna* is especially common on reefs in western San Blas, near the STRI field station. As with stony corals, turbidity apparently limits the vertical distribution of gorgonians in San Blas. Almost all gorgonians are found above 20m, and species restricted to deep water (> 20m) at other sites (e.g., *Ellisella)* can occur in less than 15m in San Blas. On offshore reefs with clearer water, species composition is more extensive and vertical distribution is comparable to other locations in the Caribbean [see Bayer (1961) or Humann (1993) for gorgonian identification].

Sponges are another prominent feature on many reefs of Caribbean Panama. Although relatively unexplored, the sponge

fauna of San Blas appears extremely rich, and many of the 640 sponge species reported from the Caribbean (van Soest 1994) probably occur in the region. Common species known from San Blas are listed in Table 4. This list is by no means exhaustive. A few of the species that are common in San Blas have only recently been described from Colombia (Zea and Rützler 1983; Zea and van Soest 1986). The sponge fauna of shallow leeward reefs (< 8 m) in San Blas is unusually rich, with levels of diversity and biomass that are typically encountered only on deeper reefs (10-30 m) elsewhere in the Caribbean. On such reefs, erect branching, massive, and tube sponges are large and abundant, even in water as shallow as 2 m. Panama's position south of the hurricane belt may explain this geographic pattern in sponge zonation; very shallow sponge populations in San Blas were devastated in 1988 by the only hurricane to pass through the region in the last 100 years (Wulff 1995).

Algae flourish on many San Blas reefs. How nutrient enrichment from river discharge and the die-off of *Diadema* contribute to this abundance is not known. Macroalgal cover in San Blas has increased roughly twofold since the mid-1980s and currently exceeds 60 percent cover on many reefs in the region (Shulman and Robertson in press, H. Guzman unpub data). During that time, genera such as *Lobophora*, *Dictyota*, *Halimeda*, and *Caulerpa* have overgrown smaller corals and occasionally come to dominate larger areas. For example, a large, dense bed of *Agaricia* found below 7 m along Sardingan Point twenty years ago (Robertson and Glynn 1977) is now almost completely overgrown by *Lobophora variegata*. Although more than 200 species of marine algae are reported from Panama's Caribbean coast (Taylor 1960; Earle 1972; Hay 1981), specific data on algal populations in San Blas are sparse. Table 5 presents a list of common algae we have observed in various habitats of the region. Identification is often kept to the generic level due to questionable species identity or unsettled taxonomy.

STRI has maintained a field research station at the western end of Kuna Yala since 1977 (Fig. 1B), and the surrounding reefs are some of the best studied in the world. The station sits amidst a variety of coral reef environments, including classic fringing reef (1-30 m depth), a small barrier reef and lagoon, over one hundred small (10^2-10^4 m^2) patch reefs, as well as nearshore reef and mangrove habitats. Four houses, a workshop, a dive locker, and six small boats provide basic but comfortable accommodations for up to 18 visitors. Minimal laboratory facilities include several microscopes and a rudimentary seawater system for aquaria. This region of San Blas, as well as others farther east, is accessible by daily commercial flights from Panama City ($50-60 round-trip). Several hotels on immediately adjacent islands provide local transportation, accommodation, and food for $25-40/day.

Bocas del Toro

A network of islands and reefs overlie ancient marine sediments along Panama's northwestern coast, near the Costa Rican border. Known as Bocas del Toro (Fig. 1A), the area contains extensive, shallow water (to 15 m) reef habitat. The general appearance and structure of reefs in this area contrast sharply to those in San Blas. In Bocas del Toro, large swells and the lack of protective barrier reefs along the extremely narrow continental shelf typically limit coral morphology along exposed shores to massive or encrusting forms of *Siderastrea*, *Acropora*, *Porites*, and *Montastraea*. Stocky gorgonians infrequently emerge from shallow fissures in the reef. While small parrotfish, wrasses, surgeonfishes, and several butterflyfishes are common in these habitats, many other reef fishes are either absent or found only in low densities. Fish and coral diversities increase in protected pockets of coastline, but even here, coral morphology is generally massive or encrusting. Shallow habitats (< 1 m) feature many gobies and blennies, including the spectacular, rarely seen, greenbanded goby (*Gobiosoma multifasciatum*).

Extensive back-reef and lagoonal habitat dominated by grassbeds, sand, and mangroves, occur in the large Laguna de Chiriqui, located between the islands and the mainland. Patch reefs and deeper fringing reefs occur here, although heavy silting from floods of the nearby Changinola river may affect their development. Coral cover is often less than 20%, with heavy growth of macroalgae. Corals such as *Porites* spp, *Millepora* spp, *Agaricia* spp, and *Madracis mirabilis*, as well as many soft corals (including *Plexaura*,

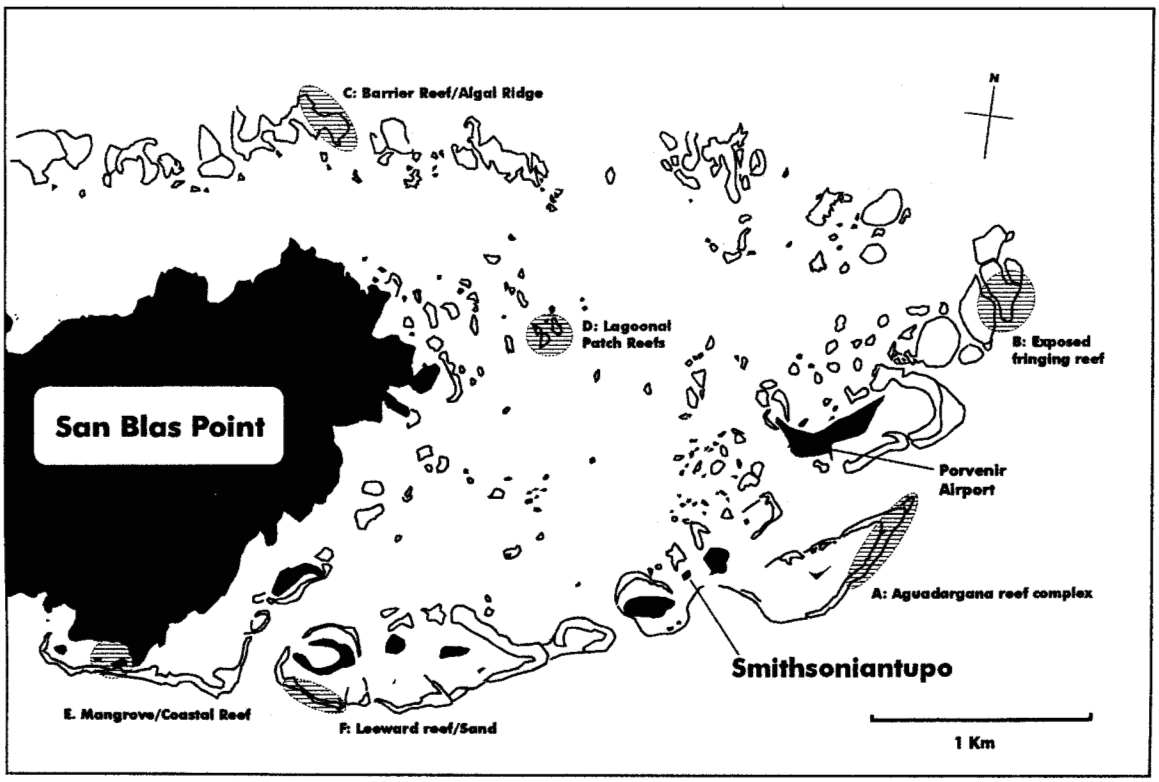

Fig. 2: Map of San Blas point for Panama I field trip (days 1 and 3) showing habitat types.

Pseudoplexaura, *Pseudopterogorgia*, *Eunicea*, *Pterogorgia* and *Gorgonia*) and sponges abound in areas of higher current flow. The majority of these reefs are shallow (< 10 m), although a few extend to a depth of 20 m before giving way to fine grain sands and silt. Mangrove habitat, home to many juvenile reef fishes as well as the upside-down jellyfishes *Cassiopea frondosa* and *C. xamachana*, is extremely abundant along the leeward side of the archipelago.

The reef fish communities in the Bocas del Toro Archipelago are generally less diverse than their counterparts in San Blas, particularly on exposed reefs, where lack of cover may limit adult populations. Fishing in the Bocas region is both widespread and more technically advanced than in San Blas, so large fish are infrequent and wary. As in San Blas, adult lobster, conch, and octopus are uncommon due to overfishing. Large schools of mid-sized herbivores (surgeonfishes, parrotfishes, and chubs) form the most conspicuous fish assemblages.

Accommodations in the region are available at several hotels in the city of Bocas del Toro ($10-20/day), or with prior arrangement, at a dormitory maintained by the Panamanian conservation group A.N.C.O.N. (arrangements for dormitory use can be made through STRI's Visitor Service Office in Panama City). Local boats are available for hire. Daily flights ($80 round-trip) shuttle between Panama City and Bocas del Toro.

FIELD TRIP DESCRIPTIONS AND SCHEDULE

Panama I: San Blas Point
This three day trip explores the various nearshore and open water reef habitats of San Blas point, at the western end of Kuna Yala (Fig 2). All dives will be with snorkel only. Participants will stay at Hotel San Blas on Nalunega, a small island/village neighboring STRI's field station, ~ 2 km offshore. There is no electricity or running water on the island, but fresh water is available for bathing and rinsing gear. In addition to personal dive gear, a towel, rubber-soled booties or tennis shoes, hat, sunscreen, sunglasses, and flashlight are recommended. Attire is casual; biting insects are not a problem.

Day 1: 7 AM; Participants will fly from Panama City to Porvenir (30 min.), then transfer to the hotel by boat (10 min.). Refreshments and a brief orientation at the hotel will be followed by a tour of STRI's field station. After lunch, snorkeling will commence at the Aguadargana reef complex (Fig 2, site A). This area includes steeply sloping (to 25 m) fore-reef habitat dominated by *Agaricia*, *Montastraea*, and *Millepora* spp. Extensive growths of *Acropora palmata* and many gorgonians occur along the northeast shelf. Shallow back-reef areas of rubble and sand are fringed by massive corals (species of *Colpophyllia*, *Diploria*, *Siderastrea*, and *Montastraea*) and are the home of many juvenile fishes and territorial damselfish (*Stegastes*). The back reef quickly grades to shallow seagrass meadows where numerous parrotfish (particularly species of *Sparisoma*) are found.

Day 2: All day trip (by boat, 1 hr) to the Limones island chain (Fig 1B), a reef-fringed archipelago lying 10 km off the coast. Generally clear water and undisturbed conditions support high coral diversity and abundant populations of fish, soft corals, sponges, and macroalgae. Although north facing reefs are exposed to dry-season surge and currents and coral morphology is correspondingly often massive or encrusting, extensive groves of *Acropora palmata* persist in some areas. To the south, well developed fore-reef habitat dominated by species of *Montastraea* and *Agaricia* drops to 30 m. Extensive shallow lagoonal areas of sand, rubble, and seagrass (*Thalassia testudinum*) support juvenile fishes and many benthic invertebrates.

Day 3: Travel by boat to various reef habitats in and around the 15 km^2 reef complex along San Blas point (Fig 2). Initially we will explore several stretches of exposed fringing reef to the North of Porvenir, where large caves and channels are maintained by wave action and currents (Fig 2, site B). Next we will transect a barrier reef (Fig 2, site C), moving from the exposed fore-reef, dominated by crustose coralline algae (*Porolithon pachydermum*), to the protected back reef areas that support a diverse community of coral reef species including many solitary corals, herbivorous fishes, and a variety of macroalgae. The morning low tide should allow examination of several small sections of algal ridge (swell permitting). Finally we will visit several lagoonal patch reefs dominated by species of *Agaricia* and *Millepora* (Fig 2, site D). These isolated reefs, surrounded by a sand halo and *Thalassia* grassbed habitat (2-5 m) are a major focus of coral reef population ecology studies by Smithsonian scientists. After lunch we will move to the protected mangrove habitat where many juvenile fishes occur (Fig 2, site E). We will then swim ~ 100 m from the mangroves over shallow grassbeds to protected coastal reefs dominated by species of *Porites* and *Agaricia* with occasional massive corals, such as *Colpophylia natans* and *Montastraea annularis*. Many sponges and soft corals persist in these protected waters, although runoff from nearby rivers can produce silting during the wet season. The well developed reefs in this area drop quickly to 30 m. However, much of the *Agaricia tenuifolia* that formerly (early 1980s) dominated the reef between 5-15 m is now overgrown by macroalgae, particularly *Lobophora variegata* (Phaeophyta). Our last stop will be along protected sand, rubble, and grassbed shoals that extend to the south of islands in the region (Fig 2, site F). Scattered corals, sponges, and gorgonians occur throughout these regions and herbivorous fishes are plentiful.

Day 4: 7 AM flight to Panama City (30 min.).

Panama III (Coiba/San Blas)
All field trips involving SCUBA diving in San Blas will originate from a small hotel on Kuanidup, one of the Los Grullos Cays, ~ 8 km offshore (Fig. 1B). The hotel occupies almost the entire island and provides comfortable, but basic, living conditions for up to 20 guests (no electricity or running water, although fresh water for bathing and rinsing gear is available). No outside services (stores, laundry) are available in this remote location. In addition to personal dive gear, a towel, rubber-soled booties or tennis shoes, hat, sunscreen, sunglasses, and flashlight are recommended. Attire is casual. Biting insects are not present. Nearby reefs will be visited by cayuco (dugout canoe) with an outboard motor; larger dive boats will be used for longer trips.

Days 1-3: Field trips near Coiba, Pacific Panama.

Day 4: Participants will take a morning flight to Rio Sidra from Coiba (90 min.) then travel by boat (45 min.) to the hotel. A brief orientation will follow. After unpacking, we will snorkel on a nearby patch reef for an introduction to Panama's Caribbean fauna and flora. Surrounded by a sand halo that drops into deeper (20-30 m) water on its southeastern edge, this shallow (1-4 m depth), ~ 1 hectare reef is typical of many sheltered inshore reefs in San Blas. Major reef building corals such as *Montastraea annularis*, *Agaricia* spp, and *Millepora* spp, dominate the shallow areas, interspersed with smaller colonies of many other common corals (including species of *Acropora*, *Diploria*, and *Siderastrea*). Reef fish (particularly herbivores) abound, as do many sponges and octocorals. Macroalgae such as *Halimeda*, *Dictyota*, and *Padina* overgrow sections of dead coral. Trails of the heart urchin, *Meoma ventricosa*, wind throughout the surrounding sand halo, where several species of sea cucumbers (Holothuriidae) and pen shells (*Penna carnea*) are also common.

After lunch we will travel by boat to the northern part of Los Grullos Cays (10 min.) for a SCUBA dive and for snorkeling along the shallow (5-10 m deep) reef edge dominated by *Millepora*, *Agaricia*, and *Montastraea* (Fig 1B). Reproductive tactics of reef fishes including several labrids (e.g. *Thalassoma bifasciatum*, *Clepticus parrae*), scarids (*Scarus iserti*, *Sparisoma viride*), and pomacentrids (*Stegastes planifrons*, *S. dorsopunicans*, and *S. leucostictus*) will be highlighted.

Day 5: We will depart for Salar (Fig 1B) at 7:00 AM (40 min. boat ride). This network of islands and banks lies ~ 8 km offshore, in a relatively unpopulated region of San Blas. Protected by the Holandes island chain, 8 km farther offshore (see day 6), this area generally offers clear, calm water and undisturbed reefs. After passing through a shallow (1-9 m) zone, where *Acropora palmata*, *Millepora alcicornis*, and species of macroalgae (including *Halimeda opuntia*, *H. tuna*, several *Dictyota* spp, and *Lobophora variegata*) generate most of the cover on the shallower reef, we will SCUBA dive along the edge of the fore-reef wall (15-20 m). Dominated by platy growths of *Montastraea annularis*, *Porites* spp, and *Agaricia lamarcki*, with buttresses of *Colpophylia natans* and small channels with *Halimeda* derived sand, this spectacular drop-off often features larger resident fishes (Serranidae, Lutjanidae), as well as open water species (Carangidae, Scombridae). Many antipatharians and sponges extend out from the reef below the drop-off. Large schools (> 200 individuals) of surgeonfish (*Acanthurus coereleus*, *A. bahianus*, *A. chirurgus*) and parrotfish (*Scarus iserti*) forage along the upper reef, consuming algal turf defended by territorial pomacentrids (*Stegastes planifrons*, *S. dorsopunicans*).

After lunch at Salar, we will make a SCUBA dive that transits from the fore-reef (described above) to the back reef. Zones of *Acropora palmata* grade into zones of *Palythoa* spp. and *Porites porites*, with scattered colonies of *Siderastrea siderea*, *Diploria*, *Montastraea*, and *Millepora*. Many juvenile reef fish occupy this habitat. From there we will shed tanks, and snorkel into shallow (3-4 m) seagrass (*Thalassia testudinum*) habitat, where fishes such as *Sparisoma radians*, *Cryptotomus roseus*, and *Halichoeres poeyi* abound. Sightings of less common species such as the cornet fish, *Fistularia tabacaria*, and the flying gurnard, *Dactylopterus volitans*, are also possible.

An optional night snorkel will visit patch reef habitat on Kuanidup. Nocturnal fishes, confined to caves and crevices during the day (e.g. holocentrids, apogonids, and pempherids), are typically found in abundance, while diurnal species (particularly scarids) may be sleeping on the reef or in sponges. Brittlestars, crinoids and the basket brittlestar (*Astrophyton muricatum*) commonly emerge to feed at reef promontories. Many other diurnally cryptic invertebrates may also be encountered.

Day 6: We will depart for the Holandes island chain at 6:00 AM (90 min. boat ride). This isolated archipelago, 15 km offshore, features one of the highest known diversities of Caribbean corals (Glynn 1973). The water is generally quite clear, but the exposed reefs can be turbulent with strong currents, depending on wind and wave action. We will dive on the leeward side. The shallow (1-4 m) leeward reef of crustose coralline algae (*Porolithon pachydermum*) and scattered corals (*Acropora palmata, Montastraea annularis, Siderastrea siderea, and Porites astreoides*) becomes dominated by *Porites porites* at depths of 4-10 m. The reef slope (10 -20 m) features massive corals such as *Diploria strigosa*, *Colpophyllia natans*, and *Montastraea annularis* (along with at least 15 other species of coral; Table 1). The soft coral and sponge communities are equally spectacular. At ~ 10 AM (low tide), we will take a walk along the algal ridge—sea conditions permitting—and snorkel along its seaward side. This unique non-coral reef structure is one of the best developed algal ridges in the Caribbean (Glynn 1973). The ridge is home to many invertebrates and features bioerosion from sea urchins, worms, and parrotfish. The encrusting red coralline algae *Porolithon pachydermum* is the major cover here, although encrusting forms of *Acropora palmata*, *Porites astreoides*, and the zoanthid *Palythoa caribbea* are also common. Sightings of sharks (*Ginglymostoma cirratum*, *Carcharhinus perezi*), large groupers (*Epinephelus striatus*, *Mycteroperca bonaci*), and snappers (*Lutjanis jocu*) are not uncommon within the transition zone from back- to fore-reef.

After lunch we will move to the northwestern tip of the archipelago to make a final shallow SCUBA dive (10-5 m) along a protected slope of scattered reef and sand. Sponges and octocorals abound between massive colonies of *Montastraea annularis*. Fish diversity is particularly high in this area. After arriving at Kuanidup in mid afternoon, participants may snorkel at reefs near the lodge or visit the Kuna village of Rio Sidra (15 min boat ride).

Day 7: Depart for Panama City at ~ 7:00 AM.

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REFERENCES

Bayer FM (1961) The shallow-water Octocorrallia of the West Indian region. Martinus Nijhoff, The Hague

Böhlke JE, Chaplin CCG (1992) Fishes of the Bahamas and adjacent tropical waters. 2nd Edition. Livingston Publishing, Philadelphia

Clifton KE (1995) Asynchronous food availability on neighboring Caribbean coral reefs determines seasonal patterns of growth and reproduction for the herbivorous parrotfish *Scarus iserti*. Mar Ecol Prog Ser 116:39-46

Coates AG, Obando JA (1996) The geologic evolution of the Central American Isthmus. In: Jackson JBC, Budd AF, Coates AG (eds) Evolution and environment in tropical America. University of Chicago Press, Chicago

Cubit JD, Caffey HM, Thompson RC, Windsor DM (1989) Meteorology and hydrography of a shoaling reef flat on the Caribbean coast of Panama. Coral Reefs 8:59-66

de Laubenfels MW (1936a) A discussion of the sponge fauna of the Dry Tortugas in particular and the West Indies in general, with materials for a revision of the families and orders of the Porifera. Papers from Tortugas Lab 30:1-225

de Laubenfels, MW (1936b) A comparison of the shallow-water sponges near the Pacific end of the Panama Canal with those at the Caribbean end. Proc. U.S. National Museum 83:441-466

de Laubenfels MW (1950) The Porifera of the Bermuda Archipelago. Trans Zool Soc Lond 27:1-201

de Weert WH, Rützler K, Smith KP (1991) The Chalinidae (Porifera) of Twin Cays, Belize, and adjacent waters. Proc Biol Soc Wash 104:189-205

Diaz MC, Pomponi SA, van Soest RWM (1993) A systematic revision of the central west Atlantic Halichondrida (Demospongiae, Porifera). Part III: Description of valid species. Sci Mar 57:283-306

Earle SA (1972) A review of the marine plants of Panama. Bull Biol Soc Wash 2:69-87

Glynn PW (1973) Aspects of the ecology of coral reefs in the western Atlantic region. In: Jones O, Endean R (eds) Biology and geology of coral reefs. v. 2 Biology. Academic Press, New York pp 271-324

Hechtel, GJ (1965) A systematic study of the Demospongiae of Port Royal, Jamaica. Peabody Museum of Natural History, Yale University Bulletin 20:1-103

Hendler G, Miller JE, Pawson DL, Porter MK (1995) Sea stars, sea urchins, and allies: echinoderms of Florida and the Caribbean. Smithsonian Institution Press, Washington

Holst I, Guzmán HM (1993) Lista de corales hermatipocos (Anthozoa: Scleractinia; Hydrozoa; Milleporia) a amblos lados del istmo de Panama. Rev Biol Trop 41(3):871-875

Howe J (1986) The Kuna gathering: contemporary village politics in Panama. Latin American Monographs, no 67. University of Texas Press, Austin

Humann P (1992) Reef creature identification. New World Publications, Jacksonville

Humann P (1993) Reef coral identification. New World Publications, Jacksonville

Humann P (1994) Reef fish identification. 2nd Edition. New World Publications, Jacksonville

Lasker HR, Peters EC, Coffroth MA (1984) Bleaching of reef coelenterates in the San Blas islands, Panama. Coral Reefs 3:183-190

Lessios HA, Robertson DR, Cubit JD (1984) Spread of *Diadema* mass mortality throughout the Caribbean. Science 226:335-337

Littler DS, Littler MM, Bucher KE, Norris JN (1989) Marine plants of the Caribbean. Smithsonian Institution Press, Washington

Munro JL, Parrish JD, Talbot FH (1987) The biological effects of intensive fishing upon coral reef communities. In: Salvat B (ed) Human impacts on coral reefs: facts and recommendations Antenne Mus. E.P.H.E., Moorea, pp 41-49

Newmann CJ, Cry CW, Caso EL, Jarvineu BR (1981) Tropical cyclones of the northern Atlantic Ocean, 1871-1980. National Climatic Center, Ashville

Pulitzer-Finali G (1986) A collection of West Indian Demospongiae (Porifera). In appendix, a list of the Demospongiae hitherto recorded from the West Indies. Annali Mus. Civ. Stor. Nat. Giacomo Doria 86:65-216

Randall JE (1983) Caribbean reef fishes. 2nd Edition. T.F.H. Publications, Hong Kong

Robertson DR (1987) Responses of two coral reef toadfishes (Batrachoididae) to the demise of their primary prey, the sea urchin *Diadema antillarum*. Copeia 1987:637-642

Robertson DR (1991) Increases in surgeonfish populations after mass mortality of the sea urchin, *Diadema antillarum*, in Panama indicate food limitation. Mar Biol 111:437-444

Robertson D.R, Glynn PW (1977) Field guidebook to the reefs of San Blas Islands, Panama. Proc 3rd Inter Coral Reef Symp, University of Miami, Florida

Rützler K (1986) Phylum Porifera (Sponges). In: Sterrer W (ed) Marine fauna and flora of Bermuda: a systematic guide to the identification of marine organisms. John Wiley and Sons, New York, pp111-127

Rützler K, Smith KP (1992) Guide to western Atlantic species of *Cinachyrella* (Porifera: Tetillidae). Proc Biol Soc Wash 105:148-164

Rützler K, Smith KP (1993) The genus *Terpios* (Suberitidae) and new species in the *"Lobiceps"* complex. Sci Mar 57:381-393

Shulman MJ, Robertson DR (in press) Changes on reefs in San Blas, Caribbean Panama: 1983-1990. Coral Reefs

Taylor (1960) Marine algae of the eastern tropical and subtropical coasts of the Americas. University of Michigan Press, Ann Arbor

van Soest RWM (1978) Marine sponges from Curacao and other Caribbean localities. Part I. Keratosa. Studies fauna of Curacao and other Caribbean Islands 56:1-94.

van Soest RWM (1980) Marine sponges from Curacao and other Caribbean localities. Part II. Haplosclerida. Studies fauna of Curacao and other Caribbean Islands 191:1-173

van Soest RWM (1984) Marine sponges from Curacao and other Caribbean localities. Part III. Poecilosclerida. Studies fauna of Curacao and other Caribbean Islands 199:1-167

Ventocilla J, Herrera H, Núñez V (1995) Plants and animals in the life of the Kuna. Austin, University of Texas Press

Wiedenmayer F (1977) Shallow-water sponges of the western Bahamas. Birkhauser Verlag, Basel

Woelkerling WJ 1976. South Florida benthic marine algae. Sedimenta V. Comparative Sedimentology Laboratory, Division of Marine Geology and Geophysics, Rosentiel School of Marine and Atomospheric Science. University of Miami, Miami

Wulff JL (1995) Effects of a hurricane on survival and orientation of large erect coral reef sponges. Coral Reefs 14:55-61.

Zea S (1987) Esponjas del Caribe Colombiano. Dictyoceratida, Dendroceratida, Verongida, Haplosclerida, Poecilosclerida, Halichondrida, Axinellida, Desmophorida y Homosclerophorida. Ed. Catálogo Científíco, Bogotá D.E.

Zea S, Rützler K (1983) A new species of *Xestospongia* (Porifera: Demospongea) from the Colombian Caribbean. Caldasia 13:817-831

Zea S, van Soest RWM (1986) Three new species of sponges from the Colombian Caribbean. Bull Mar Sci 38:355-365

APPENDIX A: TABLES OF LOCAL FAUNA AND FLORA

Table 1: Members of the Phylum Cnidaria in San Blas, Panama, including stony corals, gorgonians and anemones, hydroids, and jellyfish. Abundance at a given depth as follows: ••• : abundant; •• : common; • : occasional.

	Depth			Comments
	< 5 m	5 to 15 m	>15 m	
Anthozoa				
Scleractinia (stony corals)				
Astrocoeniina				
Acroporidae				
Acropora cervicornis	•	•	•	
Acropora palmata	•••	••		
Astrocoeniidae				
Stephanocoenia intersepta		••	••	
Pocilloporidae				
Madracis decactis		••	••	
Madracis mirabilis	•••	••	••	
Fungiina				
Agariciidae				
Agaricia agaricites	•••	•••	•••	
Agaricia tenuifolia	•	•••	•••	
Agaricia fragilis	•	••	••	
Agaricia lamarcki	••	•••	••	
Agaricia undata	•	••	••	
Leptoseris cucullata	•	••	••	
Siderastrea siderea	•••	•••	••	
Siderastrea radians	•••	••		
Poritidae				
Porites porites	•••	•••	•	
Porites furcata	•••	•••	•	
Porites divaricata	•••	•••	•	
Porites astreoides	•••	•••	••	
Faviina				
Faviidae				
Colpophyllia natans	•••	•••	•	
Diploria strigosa	•••	•••	•	
Diploria clivosa	•••	••	•	
Diploria labyrinthiformis	•••	••	•	
Favia fragum	•••	••	•	
Manicina areolata	•••	•••	••	
Cladocera arbuscula	••	••		
Montastraea annularis	•••	•••		
Montastraea faveolata	••	•••	•••	
Montastraea franksi	•	•••	•••	
Montastraea cavernosa	•••	•••	•••	
Solenastrea bournoni	••			
Oculinidae				
Oculina diffusa	••	•		
Meandrinidae				
Meandrina meandrites	••	••	••	
Dichocoenia stokesii	•	•••	••	
Mussidae				
Mussa angulosa	•	•••	•••	
Isophyllia sinuosa	••	••		
Isophyllastrea rigida	•••	••		
Scolymia lacera	••	•••	••	
Scolymia cubensis		••	••	
Mycetophyllia aliciae		••	••	
Mycetophyllia lamarckiana	•••	•••	•	
Caryophylliidae				
Eusmilia fastigiata	••	••	••	
Gorgonacea (gorgonian corals)				
Scleraxonia				
Anthothelidae				
Erythropodium caribaeorum	••	••		
Briareidae				
Briareum asbestinum	••	••		
Holaxonia				
Plexauridae				
Eunicea fusca	••	••		
Eunicea laxispica		••		
Eunicea calyculata	••			
Eunicea succinea	••	••		
Eunicea tourneforti	••	••		
Muricea atlantica	••	••		
Muriceopsis flavida	••	••		
Plexaura flexuosa	••	••		
Plexaura homomalla	••	••		
Plexaura kuna	•••	••	••	
Plexaurella dichotoma	••	••		
Plexaurella grisea	••	••		
Plexaurella nutans		••		
Pseudoplexaura crucis	••			
Pseudoplexaura flagellosa	••	••	••	
Pseudoplexaura porosa	••	••	••	
Pseudoplexaura wagenaari	••	••		
Gorgonidae				
Gorgonia flabellum	•			
Gorgonia ventalina	••			
Pseudopterogorgia americana	••	••		
Pseudopterogorgia bipinnata			••	

Table 1: (Cnidarians) continued

	Depth			Comments
	< 5 m	5 to 15 m	>15 m	
Pseudopterogorgia acerosa	••			
Pterogorgia spp.	••			
Ellisellidae				
Ellisella barbadensis		••	••	
Actinaria (sea anemones)				
Actiniidae				
Condylactis gigantea	•••	••		
Aiptasiidae				
Aiptasia tagetes	•••	••		
Bartholomea annulata	•••			
Heteractis lucida	•••			
Aliciidae				
Lebrunia danae	••	••		
Boloceroididae				
Viatrix globulifera	•••	•••		
Phymanthidae				
Epicystis crucifer	••			
Stoichactidae				
Stichodactyla helianthus	••			
Zoanthidea (zoanthids)				
Zoanthidae				
Palythoa grandis	••			
Palythoa caribaeorum	••			
Zoanthus pulchellus	•••			
Corallimorpharia (corallimorphs)				
Coralimorphidae				
Ricordea florida	••			
Discosomatidae				
Discoma sp	••			
Ceriantharia (tube-dwelling anemones)				
Cerianthariidae				
Arachnanthus sp	•			nocturnal
Hydrozoa				
Milliporina (fire corals)				
Milliporinidae				
Millepora alcicornis	•••	•••	••	
Millepora complanata	•••	•••		
Stylasterina (lace corals)				
Stylasteridae				
Stylaster roseus	••	••	•	
Siphonophora (siphonophores)				
Cystonectidae				
Physalia physalia	•••			dry season
Scyphozoa				
Semaeostomae (jellyfishes)				
Aurelia aurita	••	••		open water
Rhizostomae (upside down jellyfishes)				
Cassiopea frondosa	••			mangrove
Cassiopea xamachana	••			mangrove
Cubomedusae (sea wasps)				
Carybdea sp.	••			mangrove

Table 2: Fishes of San Blas, Panama, listed by habitat and abundance. Abundances as follows: •••• : abundant; several sightings expected on most dives. ••• : common; sightings frequent, but not necessarily every dive. •• : occasional; sightings not unusual, but also not expected. • : uncommon; sightings are unusual. Comments as follows: **b**: benthic; **c**: cryptic; **d**: notable display or behavior; **h**: hole or cave dwelling; **j**: juvenile; **n**: nocturnal; **o**: open water; **s**: schooling; **t**: territorial; **w**: wary of divers. These are superscripted when they apply to entire families or specific habitats. Familes are arranged alphabetically. References for fish identification: Randall (1983); Böhlke and Chapman (1992); Humann (1994).

	Shallow (1-15 m)				Deep (15-30 m)		
	coral reef	sand/ rubble	sea-grass	man-grove	coral reef	sand/ rubble	Comments
Acanthuridae (surgeonfishes)							
Acanthurus bahianus	••••[s]	••[j]	••[j]	••[j]			
Acanthurus chirurgus	••••[s]	••[j]	••[j]	••[j]			
Acanthurus coeruleus	••••[s]	••[j]	••[j]	••[j]			
Albulidae (bonefishes)							
Albula vulpes		•	•	•			s ,w
Antennariidae (frogfishes)[b, c]							
Antennarius spp	•						with sponges
Histrio histrio	••						in sargassum
Apogonidae (cardinalfishes)[n, h]							
Apogon alutus	•••						
Apogon anisolepis	••						
Apogon binotatus	••						
Apogon lachneri	•				••		
Apogon maculatus	•••				••		
Apogon pillionatus	••						
Apogon planifrons	•••						
Apogon pseudomaculatus	••						
Apogon townsendi	•••						
Astrapogon puncticulatus	••	••					
Astrapogon stellatus		••	••				with live *Strombus*
Phaeoptyx conklini	••						
Phaeoptyx pigmentarius	•••						
Phaeoptyx xenus	••				••		in sponges
Atherinidae (silversides)[s]							
Allanetta harringtonensis	•••	•••	•••	••			at surface
Allanetta stipes	••	••	••	••			at surface
Aulostomidae (trumpetfish)							
Aulostomus maculatus	•••		••	••	••		
Balistidae (triggerfishes)							
Balistes capriscus	•[j]	•[j]	•[j]		•[j]		in flotsam
Balistes vetula	••	••[j]	••[j]		••	••	
Canthidermis sufflamen°	••				••	••	
Melichthys niger°					•		
Batrachoididae (toadfishes)[b, c]							
Amphichthys cryptocentrus	•••				••		audible display
Sanopus barbatus	••				••		audible display
Belonidae (needlefishes)							
Strongylura notata	•••	••	••	•[j]			at surface
Strongylura timucu	•••	••	••	•[j]			at surface
Tylosurus crocodilus	•••	••		•[j]			often leaps
Blenniidae (combtooth blennies) [b]							
Ophioblennius atlanticus	••••						t
Parablennius marmoreus	•						
Scartella cristata	•••						
Bothidae (flounders)[b,c]							
Bothus lunatus		••	••			••	
Bothus ocellatus		••	••			•	
Branchiostegidae (tilefishes)							
Malacanthus plumieri		••	••			••	rubble mounds
Carangidae (jacks)°							
Alectis crinitus	•	•	•		•	•	
Caranx bartholomaei	•••	•••	•••		•••	•••	
Caranx crysos	•••				•••	••	
Caranx hippos	•		•		••	••	
Caranx latus	••		•				
Caranx lugubris					•		
Caranx ruber	•••	•••	•••		••	••	
Decapterus spp	••				••	••	
Elagatis bipinnulatus	•				•		
Seriola dumerili					•		
Seriola rivoliana			•		••	••	
Trachinotus falcatus	•	••	••		••	••	
Trachinotus goodei	•	•	•				
Carcharhinidae (sharks)							
Carcharhinus leucas	••	••	••		••	••	
Carcharhinus limbatus	••	••	••		••	••	
Carcharhinus perezi	••	••	••		••	••	
Negaprion brevirostris	••				••		
Rhizoprionodon terraenovae	•				•		
Chaenopsidea (flag blennies)							
Acanthemblemaria maria	•••						h
Acanthemblemaria spinosa	••						h
Chaenopsis limbaughi		•	•				
Coralliozetus bahamensis	••						b
Emblemaria pandionus		••	••				male display
Hemiemblemaria simulus	•						mimics wrasse
Chaetodontidae (butterflyfishes)							
Chaetodon capistratus	•••			•••[j]	••		
Chaetodon ocellatus	•••			•••[j]	••		
Chaetodon sedentarius	••				•		

Table 2: (Fishes) continued

	Shallow (1-15 m)				Deep (15-30 m)		
	coral reef	sand/ rubble	sea-grass	man-grove	coral reef	sand/ rubble	Comments
Chaetodon striatus	•••			••[j]	••		
Cirrhitidae (hawkfishes)							
Amblycirrhitus pinos	•••						
Clupeidae (herrings)[o, s]							
Harengula spp	•••				•		
Congridae (garden eels)[b, s]							
Heterocouger halis						••	colonial
Coryphaenidae (dolphins)[o]							
Coryphaena hippurus					•		
Dactylopteridae (gurnards)[c, d]							
Dactylopterus volitans		••	••				
Dasyatidae (stingrays)							
Dasyatis americana	•••	•••	•••	•••	••	••	
Himantura schmardae	••	••	••	••	•	••	
Diodontidae (porcupinefishes)							
Chilomycterus antennatus	••	••	••		•	•	c
Chilomycterus antillarum	•	•	•		•	•	c
Diodon holocanthus	•••				••		h n
Diodon hystrix	•••						h n
Echeneidae (remoras)							
Echeneis naucrates	••	••	••	••	••	••	ectoparasite
Elopidae (tarpons and ladyfishes)							
Elops saurus		•	•	•		•	w
Megalops atlanticus	••	••	••	•	••	••	
Engraulidae (anchovies)[s]							
Anchoa lyolepis	••						locally abundant
Ephippidae (spadefishes)[s]							
Chaetodipterus faber	••				••		
Fistulariidae (cornetfishes)							
Fistularia tabacaria	•	••					
Gerreidae (mojarras)							
Gerres cinereus	••	•••	•••				
Eucinostomus melanopterus	•	••	••				
Gobiesocidae (clingfishes)[b, c]							
Acyrtops beryllina			••				on seagrass blades
Gobiidae (gobies)							
Coryphopterus dicrus		••	••	•		••	b
Coryphopterus glaucofraenum		•••	•••	•••		•••	b
Coryphopterus personatus	•••				•••		h s
Ioglossus helenae		••	••			••	hover over sand
Gnatholepis thompsoni		••••	••••	••		•••	b
Gobiosoma dilepsis	•						b
Gobiosoma illecebrosum	•••	••	••		•		b cleaner
Nes longus			•••	••			b in shrimp burrow
Grammatidae (basslets)[h]							
Gramma loreto	•••				•••		
Gramma melacara					••		
Grammistidae (soapfishes)[c, h, n]							
Rypticus saponaceus	•				•		
Rypticus subbifrenatus	••						
Haemulidae (grunts)							
Anisotremus surinamensis	•				•		
Anisotremus virginicus	••				••		
Haemulon aurolineatum	•••				•••		
Haemulon bonariense	•••				•••		
Haemulon chrysargyreum	•••				•••		
Haemulon flavolineatum	•••				•••		
Haemulon macrostomum	•••				•••		
Haemulon melanurum	•••				•••		
Haemulon parra	•••				•••		
Haemulon plumieri	•••				•••		
Haemulon sciurus	•••				•••		
Haemulon striatum	•••				•••		
Hemiramphidae (halfbeaks)							
Hyporamphus unifasciatus	••	•••	••	••			at surface
Holocentridae (squirrelfishes)[n, h]							
Flammeo marianus	••				••		
Holocentrus ascensionis	•••				••		
Holocentrus rufus	•••				••		
Myripristis jacobus	•••				••		
Sargocentron coruscum	•••				••		
Sargocentron vexillarium	•••				••		
Inermiidae (bonnetmouths)[o, s]							
Inermia vittata	••				•••		
Kyphosidae (chubs)							
Kyphosus sectatrix	•••				•••		
Labridae (wrasses)							
Bodianus rufus	•••				••		
Clepticus parrae	••				•••		
Doratonotus megalepis			••				c
Halichoeres bivittatus	••••	•••	•••	•••	••		
Halichoeres garnoti	•••		••	••	••		
Halichoeres maculipinna	•••			•	••		
Halichoeres pictus	••				••		
Halichoeres poeyi	•••	•••	••••	••			
Halichoeres radiatus	••				••		
Lachnolaimus maximus	••[j]	••[j]	••[j]		••		
Thalassoma bifasciatum	••••	••	••	••	•••		
Xyrichthes martinicensis		••	••			•	dive in sand

Table 2: (Fishes) continued

	Shallow (1-15 m)				Deep (15-30 m)		
	coral reef	sand/ rubble	sea-grass	man-grove	coral reef	sand/ rubble	Comments
Xyrichthes novacula		••				••	dive in sand
Xyrichthes splendens		•				••	dive in sand
Labrisomidae (scaled blennies)							
Labrisomus guppyi	••						b
Labrisomus nuchipinnis	••						b
Lucayablennius zingaro	••				••		mimics goby
Malacoctenus boehlkei	••				••		t
Malacoctenus macropus	•••	•••					t
Malacoctenus triangulatus	••••	••					t
Lobotidae (tripletails)[o]							
Lobotes surinamensis	•						floats like leaf
Lutjanidae (snappers)							
Lutjanus analis	•••	•••	•••	•••[j]	••	••	
Lutjanus apodus	•••	••	••	••[j]	•••		
Lutjanus buccanella	•[j]	•[j]	•[j]	•	•		
Lutjanus campechanus					••	•	
Lutjanus cyanopterus	••	••	••		••	••	
Lutjanus griseus	•••	••	••	••[j]	•••	•	
Lutjanus jocu	••			•[j]	••		
Lutjanus mahogoni	•••	•	•	••[j]	•••		
Lutjanus synagris	••	•[j]	•[j]	••[j]	••		
Lutjanus chrysurus	••••	•••	•••	•••[j]	•••	•••	
Monacanthidae (filefishes)							
Aluterus scriptus	••				••		
Cantherhines pullus	•••				••		
Monacanthus ciliatus	•		•••				
Monacanthus tuckeri	••						
Monacanthus setifer	•	•	•				in sargassum
Mugilidae (mullets)							
Mugil sp			•				
Mullidae (goatfishes)							
Mulloidichthys martinicus	••••	••••	••••	••	•••	•••	
Pseudupeneus maculatus	••••	••••	••••	••	•••	•••	
Muraenidae (moray eels)[b, h]							
Echidna catenata	••				••		
Enchelycore carychroa	•				•		
Enchelycore nigricans	••				••		
Gymnothorax funebris	••				••		
Gymnothorax miliaris	••				••		
Gymnothorax moringa	•••				••		
Gymnothorax nigromarginatus	••				••		
Gymnothorax vicinus	•••				••		
Myliobatidae (eagle rays)							
Aetobatus narinari	••	••	••	••	••	••	
Ophichthidae (snake eels)							
Myrichthys breviceps	••	••	••			••	
Myrichthys ocellatus	••	••	••			••	
Opistognathidae (jawfishes)							
Opistognathus aurifrons	•	••	••			••	colonial
Opistognathus macrognathus	••	••	••				
Opistognathus maxillosus	••	••	••				
Opistognathus whitehursti	••	••	••				
Ostraciidae (trunkfishes and cowfishes)							
Acanthosrocion polygonia	••	••	••				
Acanthosrocion quadricornis	••	••	••		••	••	
Lactophyrs bicaudalis	••	••	••		••	••	
Lactophyrs triqueter	••	••	••		•		
Lactophyrs trigonus	••	••	••		•	•	
Pempheridae (sweepers)[h, n]							
Pempheris schomburgki	•••				••		
Pomacanthidae (angelfishes)							
Holacanthus ciliaris	••				••		
Holacanthus tricolor	••				••		
Pomacanthus arcuatus	•••				•••		
Pomacanthus paru	•••				•••		
Pomacentridae (damselfishes)							
Abudefduf saxatilis	••••			•[j]	••		
Abudefduf taurus	••			•[j]			
Chromis cyanea	•••				•••		
Chromis insulata					••		
Chromis multilineata	•••				•••		
Microspathodon chrysurus	••••				••		t
Stegastes diencaeus	•••				••		t
Stegastes dorsopunicans	••••				••		t
Stegastes leucostictus	•••		••				t
Stegastes partitus	••••	•••		•	••	••	t
Stegastes planifrons	••••				•••		t
Stegastes variabilis	•••				•••		t
Priacanthidae (bigeyes)[h, n]							
Priacanthus arenatus	•				•		
Priacanthus cruentatus	••				••		
Rachycentridae (cobias)							
Rachycentron canadum	•	•	•	•			
Rincodontidae (nurse sharks)							
Ginglymostoma cirratum	•••	••	••		•••		often resting
Scaridae (parrotfishes)							
Cryptotomus roseus		•	•••	••			
Scarus coelestinus	••				••	••	
Scarus coeruleus	••				••	••	
Scarus guacamaia	••				••	••	

Table 2: (Fishes) continued

	Shallow (1-15 m)				Deep (15-30 m)		
	coral reef	sand/ rubble	sea-grass	man-grove	coral reef	sand/ rubble	Comments
Scarus iserti	••••	••	•••	••••	••••	••	s, t
Scarus taeniopterus	•				•		
Scarus vetula	••				••		
Sparisoma atomarium	••	••	••	••	••	••	
Sparisoma aurofrenatum	••••	•••	•••	••	•••		
Sparisoma chrysopterum	••	•••	••••	••	••		
Sparisoma radians	•	•••	••••	••	••		
Sparisoma rubripinne	••	•••	••••	••	••		
Sparisoma viride	••••	••	••		•••	•••	
Sciaenidae (drums and croakers)[h, n]							
Equetus acuminatus	••				••		
Equetus punctatus	••				••		
Odontoscion dentex	•••				••		
Scombridae (mackerel and tunas)°							
Euthynnus alletteratus	•				••		
Euthynnus pelamis					•		
Scomberomorus brasiliensis	••				••		
Scomberomorus cavalla	•				•		
Scomberomorus regalis	•••				•••		
Scorpaenidae (scorpionfishes)[b]							
Scorpaena calcarata	•	•			•		
Scorpaena grandicornis			•		•		
Scorpaena plumieri		••	••	••		•	d
Scorpaenodes caribbaeus	••				•		
Serranidae (groupers and basses)							
Alphestes afer	•	••	•••	•	•		c
Epinephelus adscensionis	••				••		
Epinephelus cruentatus	••••				•••		
Epinephelus fulvus	•••				•••		
Epinephelus guttatus	••				••		
Epinephelus itajara	•				••		
Epinephelus striatus	••				••		
Hypoplectrus unicolor	••••				•••		
Liopropoma carmabi	•				•		
Liopropoma rubre	••				••		
Mycteroperca bonaci	••		••		••		
Mycteroperca interstitialis	••		•		••		
Mycteroperca rubra	••		•		••		
Mycteroperca tigris	••		•		••		
Mycteroperca venenosa	••		•		••		
Serranus baldwini	•	•••	••	••	•		
Serranus flaviventris	••	••	••	•		••	
Serranus tabacarius	•	•••	••			•••	
Serranus tigrinus	•••	••	••	••	••	••	
Serranus tortugarum		••				•••	
Sparidae (porgies)							
Calamus calamus	••	•••	•••	••			
Sphyraenidae (barracudas)							
Sphyraena barracuda	•••	••	••	•••[j]	•••	••	
Sphyraena picudilla	•	•	•		•		
Sphyrnidae (hammerhead sharks)°							
Sphyrna spp					•		
Stromateidae (man-of-war fishes)							
Nomeus gronovii		•	•	•			with *Physalia*
Syngnathidae (pipefishes)[b,c]							
Cosmocampus sp	••	••	••				
Hypocampus spp.	•	•	•				
Micrognathus crinitus	•	•	•				
Sygnathus pelagicus °	••	••	••				in sargassum
Synodontidae (lizardfish)[b,c]							
Synodus intermedius	•••	•••	•••	•••	••	••	
Tetraodontidae (pufferfishes)							
Canthigaster rostrata	•••	•	•	•	••	•	
Sphoeroides spengleri	••	••	••				
Sphoeroides testudineus		•	•				
Urolophidae (yellow stingrays)							
Urolophus jamaicensis	••	••	••	••			

Table 3: Common reef invertebrates of San Blas, excluding Cnidarians (Table 1) and sponges (Table 4), listed by habitat and abundance. Abundance as in Table 1. Comments as follows: **c**: cryptic; **h**: hole or cave dwelling; **n**: nocturnal; **o**: open water. These are superscripted when they apply to entire groups or specific habitats. References for invertebrate identification: Colin 1973; Humann 1992; Hendler et al. 1995.

	Habitat			Comments
	reef	grass	sand	
Ctenophora				
Tentaculifera (comb jellies) °				
Folia parallela	•	•	•	
Leucothea multicornis	••	••	••	
Mnemiopsis maccadyi	•••	•••	•••	
Ocyropsis crystallina	••	••	••	
Platyhelminthes				
Turbellaria (flatworms)				
Pseudoceros spp.	•	•	•	
Annelida				
Polychaeta (bristleworms)				
Anamobaea sp.	••		••	
Arenicola cristata			••••	
Bispira brunnea		•••		
Bispira variegata			••	
Eupolymnia sp	•••		••	
Haplosyllis sp		••		in sponges
Hermodice carunculata	•••	••	••	
Notaulax sp.			••	
Pectinaria spp			•	
Pomatostegus stellatus	••			
Sabellastarte magnifica	••••			
Spirobranchus giganteus	••••			
Arthropoda				
Crustacea (shrimp and crabs)				
Alpheus armatus		•••		
Anilocra sp	•••			on *Abudefduf saxatilis*
Calappa flammea			••	
Calappa gallus			••	
Calcinus tibicen		••		
Callinectes sp			••	
Carpilius corallinus		••		
Dardanus venosus		••	••	
Gonodactylus curacaoensis	••	••		
Justitea longimanus		•		
Lysiosquillaa sp.		••	••	
Lysmata grabhami		••		
Microphrys bicornuta		••		c
Mithrax cincitimanus		••		
Mithrax sculptus	••••			
Mithrax spinosissimus	••			
Mysidium spp.	••••			
Paguristes spp		•••		
Pagurus spp			•••	
Panulirus argus		••		h, n
Panulirus guttatus		••		h, n
Percnon gibbesi	•••			
Periclimenes pedersoni	•••			with anemones
Petochirus diogenes	•		••	
Plinurellus gundlachi		•		
Podochela spp			••	
Portunus sayi		••	•	
Portunus sebae	•••		••	
Rhynchocinetes rigens	•••			n
Scyllarides aequinoctialis	••			
Stenopus hispidus		•••		
Stenorhynchus seticornis	•••			
Synalpheus spp (> 30)	•••			
Thor amboinensis		••		
Mollusca				
Amphineura (chitons)				
Acanthopleura granulata	••			
Gastropoda (snails)				
Aplysia dactylomela	••			c
Astraea tecta	••			
Bulla striata		•••	•••	
Cassis flammea	•	••	••	
Cassis madagascarensis	•	••	••	
Cassis tuberosa	•	••	••	
Cerithium litteratum		•••		
Charonia variegata	••	••	••	
Chromodoris spp	••		••	
Chyphoma gibbosum	•••			on gorgonians
Chyphoma signatum	•			on gorgonians
Cymatium sp	••			
Cymatium pileare	••			
Cymbovula acicularis	••			
Cypraea cervis	••			
Cypraea cinerea	•			
Cypraea spurca	•			
Cypraea zebra	••			
Diadora spp	••			
Elysia spp	••	••	••	with algae
Fasciolaria tulipa	••	••	••	
Hypselodoris spp	••			
Lithopoma tectum		••		
Marginella pruniosum	•••	••		
Oliva reticularis		•••	•••	

Table 3: (Invertebrates) continued

	Habitat			Comments
	reef	grass	sand	
Oxynoe spp	••			with algae
Pleurobranchus areolatus	••			
Scyllaea pelagica	••			in Sargasso weed
Strombus costatus		••	••	
Strombus gallus	•	•	•	
Strombus gigas		••	••	
Strombus pugilis	••	••	••	
Strombus raninus	•••	•••	•••	
Trivia pediculus			••	
Tridachia crispata	••			on macroalgae
Bivalvia (clams and scallops)				
Chama macerophylla	••			
Chlamys imbricata	••			
Dendostrea frons	••			
Isognomon alatus	••			mangroves
Lima scabra	•••			
Lima pellucida	••		••	
Pinna carnea		•••	•••	
Pteria colymbus		•••	•••	
Spondylus americanus	••			
Tellina radiata		••	••	
Cephalopoda (squid and octopus)				
Loligo sp.	•	•	•	o
Octopus briareus	•••	••	••	
Octopus macropus		•		
Octopus vulgaris		•		
Sepioteuthis sepioidae	•••	•••	•••	o
Echinodermata				
Crinoidea (crinoids)				
Analcidometra armata	••			
Nemaster discoideus	••			often deep
Nemaster grandis	••			
Nemaster rubiginosus	•••			
Ophiuroidea (brittlestars)				
Amphiodia trychna	•	••	•	
Astrophyton muricatum	••			n
Ophiactis quinqueradia	•			on sponges
Ophioblenna antillensis	•			
Ophiocoma echinata	•••	•	••	
Ophiocoma pumila	•••	•	•	
Ophiocoma wendtii	•••	••	••	
Ophioderma appressum	•••			
Ophioderma rubicundum	•••			
Ophiolepis impressa	••			
Ophiolepis paucispina		•	•	
Ophionereis reticulata	•••	••	••	
Ophiothrix orstedii	•••			
Ophiothrix suensonii	•••			on sponges
Sigsbeia conifera	•			
Asteroidea (sea stars)				
Asterina foium	•			
Astropecten articulatus		••	••	
Copidaster lymani	••			
Linkia guildingii	••			
Ophidiaster guildingii	••			
Oreaster reticulatus	••	•••	••••	
Poraniella echinulata	•			
Echinoidea (urchins)				
Astropyga magnifica		•	•	deep
Clypeaster rosaceus		•••	•••	
Clypeaster subdepressus		•	•••	
Diadema antillarum	•••	••	••	
Eucidaris tribuloides	•••	••		
Echinometra lucunter	•••			
Echinometra viridis	••••			
Echinoneus cyclostomus		•		
Leodia sexiesperforata.			••	
Lytechinus variegatus	••	•••	•••	
Lytechinus williamsi	••	•••	••	
Meoma ventricosa			•••	
Tripneustes ventricosus	•••	•••	••	
Holothuroidea (sea cucumbers)				
Actinopyga agassizii	••	••	••	
Astichopus multifidus	••	•••	••	
Euapta lappa	••			n
Holothuria mexicana	••	•••	•••	
Holothuria thomasi	••			n
Isostichopus badionotus		•••	•••	

Table 4: Sponges of San Blas, Panama, listed by order. The species named here, with the exception of the cryptic species, may be found reliably during a search of less than an hour in the habitat named. Relative abundance, within the context of the designated habitat is as follows: **A**: abundant with respect to total volume; **B**: abundant with respect to number of individuals, but not necessarily volume, because individual sponges are small or encrusting; **C**: present but largely or entirely cryptic or interstitial. Useful reference works for sponge identification include: de Laubenfels (1936a,b; 1950), Hechtel (1965), Weidenmayer (1977), van Soest (1978, 1980, 1984), Rützler (1986), Pulitzer-Finali (1986), Zea (1987), de Weerdt et al. (1991), Rützler and Smith (1992, 1993), and Diaz et al. (1993).

	Shallow reef (< 8m)	Deep reef (> 8m)	Seagrass Sand/Rubble	Mangrove roots
Haplosclerida				
Amphimedon erina (de Laubenfels)	B		B	
Amphimedon caycedoi (Zea and van Soest)			B	
Amphimedon rubens (Pallas)	A	A	A	
Callyspongia vaginalis (Lamarck)	A	A		
Cribrochalina vasculum (Lamarck)		B		
Haliclona caerulea (Hechtel)	B			A
Niphates digitalis (Lamarck)		A		
Niphates erecta Duchassaing and Michelotti	A	A		
Oceanapia peltata (Schmidt)			C	
Pachypellina podatypa (de Laubenfels)	C			
Xestospongia carbonaria (Lamarck)	B			
Xestospongia muta (Schmidt)		A		
Xestospongia proxima (Duchassaing and Michelotti)	B			
Xestospongia rosariensis Zea and van Soest	A			
Xestospongia subtriangularis (Duchassaing and Michelotti)			A	
Poecilosclerida				
Desmapsamma anchorata (Carter)	A	A		
Ectyoplasia ferox (Duchassaing and Michelotti)	A	A		
Iotrochota birotulata (Higgin)	A	A		
Lissodendoryx colombiensis Zea and van Soest	A			
Monanchora arbuscula (Duchassaing and Michelotti)	A	B		
Mycale laevis (Carter)	A	A		A
Mycale laxissima (Duchassaing and Michelotti)		B		
Neofibularia nolitangere (Duchassaing and Michelotti)		A		
Raphidophlus schoenus van Soest			B	B
Tedania ignis (Duchassaing and Michelotti)				A
Halichondrida				
Halichondria sp. - pale yellow-orange	C			
Hymeniacidon caerulea Pulitzer-Finali	C			
Petromica ciocalyptoides (van Soest and Zea)			C	
Scopalina ruetzleri (Wiedenmayer)	B	A		
Dictyoceratida				
Ircinia strobilina (Lamarck)	A	A		
Ircinia campana (Lamarck)	A	A		
Ircinia felix (Duchassaing and Michelotti)	A	A		
Spongia cf. *tubulifera* (Lamarck)			A	
Dendroceratida				
Dysidea etheria de Laubenfels	B			
Verongida				
Aplysina archeri (Higgin)		A		
Aplysina cauliformis (Carter)		A		
Aplysina fulva (Pallas)	A			
Aplysina lacunosa (Pallas)		A		
Pseudoceratina crassa (Hyatt)		A		
Verongula rigida (Esper)	A	A		
Agelasida				
Agelas clathrodes (Schmidt)		A		
Agelas conifera (Schmidt)		A		
Agelas dispar Duchassaing and Michelotti		A		
Agelas schmidti (Wilson)		A		
Astrophorida				
Geodia cf. *gibberosa* (Lamarck)	C			
Erylus formosus Sollas		A		
Hadromerida				
Chondrilla nucula Schmidt		A		
Cliona delitrix Pang	A			
Cliona varians (Duchassaing and Michelotti)		A		
Placospongia carinata (Bowerbank)		B		
Spheciospongia cuspidifera (Lamarck)		A		
Spheciospongia vesparium (Lamarck)		A		
Spirastrella cf. *mollis* Verrill	B	A		
Spirastrella coccinea (Duchassaing and Michelotti)		B		
Tectitethya crypta (de Laubenfels)		A		
Tethya actinia de Laubenfels		B		
Spirophorida (= Choristida)				
Cinachyrella alloclada (Ulizka)		A		
Cinachyrella cf. *apion* (Uliczka)			B	

Table 5: Marine algae likely to be encountered by divers in western San Blas based on observations and collections by K.E.C. (using Woelkerling 1976; Littler et al. 1989; Humann 1993; species names in parentheses = probable identification). Superscripted comments regarding primary habitat as follows: **r**: reef; **s**: sand/rubble; **m**: mangrove; **e**: epiphyte; **o**: open water.

Chlorophyta

Anadyomene sp. r
Avrainvillea asarifolia. s
Avrainvillea (nigricans) s
Bryopsis pennata m
Bryopsis plumosa r
Caulerpa cupressoides s,r
Caulerpa mexicana s, s, m
Caulerpa racemosa r
Caulerpa serrulata r
Caulerpa sertularioides r, s, m
Caulerpa taxifolia r, s
Caulerpa verticillata r, m
Chaetomorpha sp. r, m
Cladophora sp. r
Codium repens r
Derbesia sp. r
Dictyosphaeria cavernosa r
Enteromorpha sp. s, m
Ernodesmis verticillata r
Halimeda copiosa r
Halimeda discoidea r, s
Halimeda goreauii r, s
Halimeda incrassata s
Halimeda monile s
Halimeda opuntia r, s, m
Halimeda simulans s
Halimeda tuna r
Microdictyon marinum r
Penicillus capitatus s
Penicillus (dumetosus) s
Penicillus pyriformis s
Penicillus spp
Rhipilia sp. r
Rhipocephalus phoenix s
Udotea flabellum s
Udotea occidentalis s
Ulva lactuca r, m
Valonia macrophysa r
Valonia (utricularis) r
Ventricaria ventricosa r

Rhodophyta

Acanthophora sp. s
Amphiroa brasiliana r
Amphiroa fragillisima r
Amphiroa hancockii r
Amphiroa rigida r
Amphiroa tribulus r
Bryothamnion sp. r
Centroceras clavulatum r
Ceramium sp. r, e
Chondria sp. r
Chrysymenia sp. r
Coelothrix irregularis r
Dasya baillouviana r
Eucheuma sp. s
Fosliella farinosa r
Galaxaura marginata r
Galaxaura oblongata r
Gelidiella acerosa r
Gelidium sp. r
Gracilaria spp. r
Haliptilon subulata r, e
Halymenia floridana. r
Hypnea sp. r
Jania adherens r
Laurencia intricata r
Laurencia sp. r
Liagora ceranoides r
Lithothamnion sp. r
Mesopyllum sp. r
Neogoniolithon sp. r
Ochtodes secundiramea r
Peyssonnelia sp. r, d
Porolithon pachydermum. r
Sporolithon episporum r
Spyridia sp. r
Wrangelia argus r

Phaeophyta

Chnoospora minima r
Cladosiphon occidentalis r, s, e
Colpomenia sinuosa r
Dictyopteris delicatula r
Dictyota (bartayresii) r
Dictyota cervicornis r, s
Dictyota divaricata r
Dictyota jamaicensis r
Ectocarpus sp. r
Hydroclathrus clathratus r, s
Lobophora variegata r
Padina (gymnospora) r, m
Padina jamaicensis r
Sargassum fluitans o
Sargassum (hystrix) r
Sargassum natans o
Sargassum. (platycarpum) r
Sargassum. polyceratium r
Stypopodium zonale r
Turbinaria turbinata r
Turbinaria tricostata r

Cyanophyta

Phormidium corallyticum r
Schizothrix calcicola r

Spermatophyta

Halophila baillonis s, m
Syringodium filiforme s
Thalassia testudinum s

APPENDIX B: INFORMATION FOR PROSPECTIVE RESEARCHERS

Research organizations in Panamá
Achotines Laboratory

Inter-American Tropical Tuna Commission

Centro de Ciencias del Mar y Limnología (CCML)

Universidad de Panamá
Departamento de Acuicultura

Dirección Nacional de Recursos Marinos

Universidad de Panamá
Departamento de Biología Acuática

Smithsonian Tropical Research Institute

Field research facilities
Smithsonian Tropical Research Institute
- Naos Marine Laboratory (Naos Island)
- San Blas field station (San Blas Islands)
- Galeta Island (Colón)
- Bocas del Toro field station (Bocas del Toro)

Departamento de Acuicultura
Ministerio de Desarrollo Agropecuario (MIDA)
Lic. Vielka Ruiz, Directora
Phone: (507) 251-1584

Laboratorio de Recursos Marinos
Ministerio de Comercio e Industrias (MICI)
Phone: (507) 251-1111

Inter-American Tropical Tuna Commission
Achotines Laboratory
Las Tablas, Provincia de Los Santos
Republica de Panamá
Dr. Vernon Scholey, Laboratory Director
Phone/FAX: (507) 295-8166

Government authorities granting permission for research, collecting, and specimen export
INRENARE (Instituto Nacional de Recursos Naturales Renovables) is in charge of the national parks of Panamá and grants permits for research and collecting within the parks. This organization also handles requests for CITES permits. The contact is:

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INRENARE
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Corregimiento de Ancón
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Recursos Marinos grants permission to work in the territorial waters of Panamá. The contact is:

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