

# Education & Awareness of Marine Environments Project

(E.A.M.E.P)

## Concerns and Solutions for the Protection of the Coral Reef in Fiji

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## **INTRODUCTION**

There are a great number of threats to coral reefs, and most of these threats can be attributed either directly or indirectly to human activities. Some good solid effort, to educate and inform the people of Fiji, must be done quickly if we are to raise the level of awareness within the various groups who earn their daily living from the sea. The list of solutions to the many coral reef problems is extensive. These range from better methods of soil containment in order to decrease runoff, to the installation of permanent moorings at heavily used anchorage sites. Whatever the proposed solutions, there is a need for adequate enforcement to ensure that the required techniques are being followed. Unfortunately, enforcement has not been consistent enough in the past but should improve in the future as important information is freely and accurately disseminated. Towards these ends, the education and cooperation of people throughout Fiji is necessary for the sake of our coral reefs.

To point an uninformed finger at one particular group or industry as the main culprit (of reef destruction) is unproductive and yields no positive results. The tendency to "protect one's own territory" too often prevails while communication breaks down between groups with the real issues getting ignored in the process. In this paper I present most of the issues surrounding the controversy over the use of our local ocean and coral reefs. I also present whatever solutions or theories exist to date to lessen the apparent negative impact of these activities. It is my intent to create a forum where unbiased facts and realistic solutions can be explored and applied wherever possible.

## **SOURCES OF REEF IMPACT**

### **NATURE**

Although much of the coral reefs degradation is directly blamed on human impact, there are several natural disturbances that cause significant damage to coral reefs. The most recognized of these events are cyclones that bring large and powerful waves to our tropical waters. These storm waves cause large corals to break apart and scatter fragments about the reefs. In addition, these storms generally bring heavy rain that increases runoff and sedimentation. After the storm, some corals are overgrown by quicker growing algae's being fed from nutrients in the runoff. However, where runoff is not a problem on the outer reefs, the fragments are able to quickly resettle and start to grow again towards the sun. It is possible to reestablish colonies of substantial size within

three years. Of course, this is a feature of the faster growing Acroporidae, a principal group of branching-type corals that are most effected by the storm.

Another common threat to coral populations of the Pacific Ocean is the Crown-of-Thorns (*Acanthaster planci*). The Crown-of-Thorns is a large Starfish that feeds on corals by extruding its stomach over the coral colony digesting the living tissue layer. These predators have had serious effects on coral populations in many regions in the South Pacific.

The widely used solution to the outbreak of large populations of these starfish is human intervention (through culling) since their only known predator is the slow moving "Triton Snail "and the starfish greatly outnumber them in a serious outbreak.

The remainder of Reef Impact topics involve human activity of some sort. It is important to point out that in most cases these activities contribute on some level to the economy of Fiji. With the exception of waste/septic tank use, all of the following can be considered an asset to the nations economy if carried out properly and the operators are held accountable for their activities.

## **TOURISM**

Tourism is one of Fiji's greatest revenue earners. It is also an undisputed fact that tourism has the greatest amount of direct human impact on our coral reefs. With over 360,000 visitors per year, the country generates approximately \$500 million in foreign exchange from tourism. A large percentage of these tourists visit our coral reefs at some point during their stay. Unfortunately, many of these tourists are uneducated in proper reef etiquette, and it is left to the dive operator to instruct his passengers how to properly conduct themselves when swimming around the coral reef. I have been on many day trips and charters and this is apparently rarely done. What too often happens is uninformed divers and snorkelers go about touching, kicking and grabbing the reef to get a better look, gain stability in the water or collect a "souvenir". Although I am certain that there are many responsible dive operators in Fiji. The recreational dive industry needs to have a written, applied "awareness management plan "for dive operators.

Anchor damage and fuel pollution are other factors that must be addressed. Although some operators use permanent moorings at their dive sites, most do not. Considering that the average dive operator may visit the same spot several times in a week it is important to realize what happens when they throw their

anchor onto the reef. A dragged anchor can clear several square meters of the reef as the boat is pushed around from wave action.

Many of the beaches around the more popular resort islands have what can be considered a "desert" for an intertidal zone. With the thousands of tourists that visit these resorts it should come as no surprise that there is nothing much for the snorkeler or glass bottom boat to see until they reach the outer reef. Much of this can easily be the unavoidable effects of tourists pouring over the reef each day. When compared to other islands with little or no tourism there is a noticeable difference in greater species diversity and abundance. The reef should be fairly luxuriant right up to within several meters of the tideline.

Another serious threat to coral reefs from tourism is the recent development of the jet propelled water sport industry. As a proponent in reef awareness, the effects of this activity should be made known to the existing operators and their customers. When a jet propelled water ski or boat skims along the surface it is capable of uprooting young corals or blowing off the branches of older corals that are within several inches from the surface. If you have ever been behind one of these machines when it takes off you know what I mean. However, this is not the most serious threat that they pose to the reef's ecology. What is probably unknown to the average operator is what lives in the top 10-12 centimeters of the sea. Within this "layer" our coral reef is just beginning to take form. Here we have billions of tiny cells and larvae developing and being nourished by the sun just before they take settlement somewhere on the reef. Combined in this layer are larval corals, reef fishes and other invertebrates. When you run a jet propelled machine across this layer it simply churns up everything in its path and spits it out. It is estimated that an average 30-minute ride on a Jet Ski kills several million newly "hatched" forms of life otherwise destined for the coral reef.

Finally, we have the problem of what to do with the disposal of human waste generated by the thousands of tourists visiting our island resorts. Many of these resorts simply pump their raw sewerage into the sea via a drainage pipeline. This presents a health problem as well as incidental reef destruction that certainly needs to be addressed in a more environmentally friendly manner for obvious reasons.

#### Possible solutions:

As part of an effective awareness campaign, at resorts where diving and snorkeling are major attractions, incoming tourists should be made aware of environmental issues concerning the coral reef. As part of a welcoming protocol



impermeable. Large "porites" boulder extraction means killing colonies that can be 40 - 100 (or more) years old.

### Possible Solutions

On the topic of using large boulders "porites" for septic tanks and drains the solution is simple. It should be a priority to educate the people using this product that it actually does not work, as they believe it does. Since easily obtainable materials are available as a suitable alternative, this coral-use industry is unnecessary.

### **CURIO CORAL:**

There are two companies currently operating in Fiji that deal in large pieces of "bleached" coral for the curio trade around the world. These companies extract live coral and then process it to be shipped by sea freight in containers to their overseas markets. Villages are employed to carry out the harvest and do most of the "drying out" at some location in or near their village. The collection is selective as the market seeks only certain species. However, this practice does appear to be destructive in nature to the casual observer. Most of the species involved in this type of collection are of the fast growing branching types (usually *Acropora*) of five to ten years old. A great percentage of colonies of these corals are considered unusable by this industry because they have been disfigured by natural causes or are simply too large or too small. Since only certain species, sizes and shapes are desired in this industry, most of the corals in any given location are left untouched by the collector. This selective harvesting allows for the continued recruitment of new coral. However, one of the biggest problems this industry faces is the training of the locals to minimize collateral damage while collecting. If the pieces become broken in handling then they become unsaleable necessitating replacement of the piece from the reef.

Another negative feature of the curio coral trade is exposure. Large piles of dead coral skeletons can be observed in the village and on trucks when an order is being filled. This can be very disconcerting to the observer without ever realizing the actual small percentage of material being collected compared to that available on the reef. Another danger to our reef environment would be the careless overuse of one area as opposed to continued and regular movement throughout a given zone. If the operator does not educate his harvesters in proper reef management and regularly check to see if it is carried out then over-exploitation can occur.

### Possible Solutions

It is possible for the curio trade to create ways to better handle their product and manage the resource. Careful monitoring of collection sites is essential and over-harvesting by the village must be curtailed. For instance, if a village has excessive or damaged product, the harvester should take responsibility for this "mistake" and take measures to ensure that this doesn't happen again. A simple and appropriate use for this mishap would be to have the exporter arrange with the village to have the product put back into the sea at the expense of the responsible party. In this way, the coral could at least provide some habitat for marine life until it becomes overgrown with new life. It is also important to rotate the movements of the harvesters on a very regular basis and make the foreman aware of sustainable practice. Concentrating on the fast growing types of corals and working with Fisheries on an appropriate quota would also ensure sustainability and increase public confidence.

Fisheries must recognize that the collection area of this industry must be large enough to allow for rotation, this would ensure sustainability. In addition, the operators should be limited to one collector per area.

### **LIVE AQUARIUM CORAL:**

Live aquarium coral is a sensitive issue involving coral collection in Fiji due to its high profile, large use of airfreight, and high employment. It is the greatest revenue earner for the economy of Fiji where coral harvest is concerned. In the eyes of its detractors, live coral collection is the worst use of our coral reefs. This view has the potential to politically destroy an otherwise viable and sustainable industry. In all reality, the aquarium coral collection industry has almost no negative impact on the coral reef and produces the greatest economic return for the country and villagers involved with this type of harvest (Lovell, 98). Because the industry maintains a high profile image, with live coral on display, large facilities and numerous personnel, it is very important to educate all of those critical of live coral collection of its minimal impact on the reef. One of the negative features in this industry is wastage. Because this industry deals in "live" coral it must remain in perfect condition through export and meet the demands of a "healthy" product in perfect condition when it reaches the overseas market. This entails knowledgeable and experienced staff and management in addition to a very expensive and professional installation to keep the coral alive and healthy for export.

It is estimated that the live coral trade currently produces approximately \$12 million per year in export revenue for Fiji. Although small when compared to tourism the average local individual income in this trade is over double that earned by those involved in tourism. However, This is only the beginning of benefit to the country. A tremendous benefit accrues to Fiji in the promotion of tourism through the viewing of our exported livestock in private and public aquariums throughout the world.

Another possible danger for this trade (to have a negative impact in Fiji) is the conflict it could cause if live coral collection was carried out within the same geographic areas that tourism and dive operators use regularly. Even though it can be proven to have no negative environmental impact it is certainly an activity that does not mix well with tourism. If we are to protect this industry then intense environmental awareness issues must be a priority when training the locals to harvest this product.

Over-collection is possible only if the operator continues to visit the same site too often. In this scenario particular species may come under pressure of depletion but it is highly unlikely that collectors would engage in this type of movement as variety is required by the industry. In a recent report it was estimated that .005% of a given site is of use to the aquarium trade. The need for a large collecting area is important, and leaving almost the entire reef intact is the result. Therefore, eminent danger exists when more than one company is allowed to work the same area. Pressure to compete for the small amount of desired size, shape and type of corals available will create waste, ultimately lowering the standards of the live coral industry. However, it is possible to visit the same sites more than once in the same year. Most of the species required by this trade are of the fast growing, colorful *Acropora* (branching) types. Since the desired colony size is typically between two and four inches this represents less than one year's growth. Almost all of the coral that is harvested for this industry is very young, with larger pieces being left in place to reproduce year after year.

#### Possible solutions:

The most sensitive among all types of coral harvest is that of the Marine Aquarium Trade. When the harvest is kept alive it is inevitable that the public becomes aware of the industry simply because of the attention it draws with large expensive equipment and colorful display of inventory. There is a general misconception by the public that most corals are slow growing and take hundreds of years to form. Although this may be true of a few species reaching

the age of more than 100 years, these are mostly the large boulder type formations that are not sought after by this industry. In most cases, the species that are in demand are extremely fast growing reaching the size desired by the aquarium trade in one to three years. When these species get very large (within ten years) they usually break off under the pressure of their own weight or heavy storms. This results in one type of reproduction of their species; fragmentation or asexual schizogyny.

One of the primary responsibilities of this industry is to inform the public on just how corals grow and the genuine concerns that the aquarium trade shares over environmental issues and exploitation of the reef resources.

It should be a high priority that operators instruct their crews and villagers on the proper ways to collect and minimize damage to the environment while collecting. Also, quotas must be strictly followed by collectors (imposed by the exporter) to eliminate over-collecting and waste. It is important to detail all collecting activity with Fisheries and work closely with them to insure a sustainable yield.

Exporters should establish areas that are not overlapping with the tourist industry and should check regularly to ensure that this does not happen.

If all participants in this industry follow these guidelines then Fiji will continue to gain from an industry that is both valuable to the economy and that creates an example of an "environmentally conscientious" aquarium trade to the rest of the world.

### **LIVE ROCK:**

Perhaps the most misunderstood harvest of all is that of a product (for lack of a better term) called "live rock". The name can be misleading because it is not live coral per se that is being sought, but many algae and other small to microscopic life forms in and on the rock itself. Some of this rock is based on old dead coral skeletons while other types consist of pieces of substrate that have been deposited on the reef flat and covered with coralline algae. The amount of product that is removed can seem excessive until the overall size of the fishery resource and sources of replenishment are taken into account. The aquarium industry seeks this product because of the important beneficial biological properties of the live rock when used in an aquarium. It is also important to point out that this item is bought and sold by weight and it is the highest income earner for the villagers participating in the aquarium trade industry. Where there is little chance of substantial employment in some of

these remote areas, a village can earn a substantial income from this otherwise useless product. In two reports just completed by reef consultants hired by the Fiji Government it was shown that live rock is definitely a sustainable resource if carried out under certain guidelines. In fact, it was stated in one of these reports that the removal of some of this old rock along the coral coast actually improved the conditions on the reef providing more "holes" where coral and fishes could re-establish in a place where there was only rock before.

It has been determined that some of the best collecting areas for this material are those that have been the most abused by either mans activities or nature. The coralline algae is able to flourish in areas that experience a great deal of runoff deposited on the reef from rivers and streams that carry nutrients and chemicals from the soil. This runoff carries large concentrations of nitrites and phosphate from agriculture and soil from land being stripped for construction or logging. This silt can make the water cloudy or muddy, smothering the coral, which can't get enough light to survive and provides the nutrients for the coralline algae to quickly overtake the area. The Coral Coast is an excellent example of this phenomenon. It has been determined that the collection of live rock from the right area is not only sustainable but also creates a favorable condition for the coral reef to flourish once again.

However, there is some threat from this type of collection if the wrong type of area is utilized. In the reports it was pointed out that the most suitable area for collection was along the outer edges of the reef flat where most of this algae covered material has taken over coral growth and fish spawning areas. Tidal lagoons and patch reefs should be avoided. A danger exists when a collector breaks off pieces of a living reef to get at the coralline algae growing underneath. Again, we have a situation that the overlapping of areas by competing companies is cause for concern. It should be the responsibility of the licensing branch of Government (in this case Fisheries) to ensure that the correct areas are being used for this type of harvest.

The quality of the rock collected can also create a problem. The industry demands that at least 60% of the rock surface be covered with the coralline algae. If low quality rock is taken, it is rejected by the exporter creating waste and unnecessary collection.

#### Possible solutions:

Since the Fisheries department is responsible for issuing the license and making the initial survey of collection areas it should be their responsibility to ensure that the right type of area is used for collection. The guidelines are simple and

it should be obvious if an area is the appropriate site for harvest of this type. It should also be the responsibility of fisheries to assess an area and establish a quota system that is manageable and offers economic value to the village where the harvest takes place.

Regarding possible waste, the collectors should make it routine to only collect rock that is required by the exporter. If unsuitable rock (with less than 60% coralline coverage) is collected, the exporter can reject this rock and pay the village a nominal fee to replace it back on the reef where it could continue to grow the required algae. Using this guideline villagers will quickly learn to minimize wasted efforts and unused product will soon become a useful export.

### **CORAL IN MEDICINE AND RESEARCH:**

Because many marine organisms rely on chemical defenses, the oceans are a promising source of new medicine. The same chemicals that protect species against predators may serve humanity in combating hypertension, cardiovascular problems, and viral and bacterial infections. Some scientists have already found a use for products from the coral reef while others continue searching.

There is some (small amount of) coral being harvested for medicinal purposes, mostly used in bone reconstruction for eye socket and jaw repair. The amount taken on an annual basis is relatively tiny. There is some talk about being able to synthesize the material in the near future so the demand for this type of extraction will almost certainly be diminished. The apparent danger in this type of collection is rumors that have circulated through the Pacific Islands that the medical industry is paying extremely high ransom for the specific type of coral that is used. This information is incorrect but in some cases it has led to the harvest of vast amounts of the wrong type of coral by collectors hoping to get in on this market. The type of coral that is used is of the genera "*Goniopora*" and the demand is for small amounts per year of a specific size and species of *Goniopora*.

Coral for research is usually carried out by visiting scientists who acquire special collecting permits well in advance of their visit. The extraction is almost always of minimal amounts and very specific. There is little chance that commercial collectors in Fiji will partake in this activity, mainly due to the specialized nature of the target material. However, if a certain type of "rare" coral were shown to have special properties that reach high demand by the medical field then the chances of depletion of that particular species could increase.

### Possible solutions:

There seems to be little or no problem currently with this arena of use. However, if the demand for a certain "new discovery" proves to be that of a rare and limited species then a conscientious evaluation must be made on its extraction for the sake of humanity.

### **CORAL FOR CONSTRUCTION:**

Fiji does not have an industry that extracts coral for the production of cement or building products and it should never start. The only exception is the harvest of sand just outside Suva Harbor and this was started after an environmental impact study was carried out and concluded that the harvest was sustainable. Fiji does not have a reef system large enough to sustain a construction or cement making industry for very long without causing serious environmental damage. In Indonesia 25,000 metric tons of raw coral is extracted for lime by one village alone each year just to produce cement mix. By comparison, all of the aquarium coral exports combined in Fiji probably do not exceed more than a couple metric tons of "raw coral" per year.

### **AQUARIUM FISH COLLECTION:**

At this time, there is no evidence to support that the collection of aquarium fishes causes a negative effect on the ecosystem or that there is any depletion in coral reef fishes in Fiji. The methods practiced by some of the established companies here have provided the best hand caught fish the industry has to offer. One collector in particular has been working on the same reefs for over fifteen years and the fish have continued to be available there in good supply. Mainly attributed to the "hand caught" methods employed (and taught) by the collectors in Fiji, the aquarium fish collection industry is sustainable. The reputation of live aquarium fishes from Fiji is widely regarded to be of the highest standards of good health and quality. On the other hand, there are other countries that are associated with some very dangerous practices and techniques involving the capture of marine aquarium fish. In Fiji we must be cautious not to let these methods be used in our industry. It is known at this time that two "newer" companies have recently started (within the last year) and employ divers from the Philippines. This country has had a long, regrettable history of utilizing unsustainable live fish collecting practices such as the use of cyanide or chlorine to stun and capture their livestock.

### Possible solutions:

One of the most obvious threats in this type of fishery is the loss of employment to the local fisherman. By training locals in the art of collecting "hand caught" aquarium fishes, our industry not only supports the local economy but also ensures the exclusion of dangerous bad habits imported into our country. Most of Fiji's spear-fisherman are naturals in the water and can be easily trained to hand catch live fishes making a very good wage to support their family and village. Specialized trainers should be allowed in this country for a short time (paid for by the exporter to train the locals) and only from countries that have a clean reputation for "hand caught/drug free" aquarium fish collection.

Fisheries should make regular checks to make sure that no cyanide or bleach is being used in the collection process. Spot checks of the collection areas will also be necessary to monitor that the coral is not being "bashed" by the collectors or killed by the use of cyanide or bleach.

Fisheries, in the way of export license requirements, records all catch numbers and this should be regularly monitored through a database. By monitoring the catch numbers we will gain useful information on the sustainability of this type of fishery.

As with coral and live rock export, the number of operators should be limited to the present number. Most of the good usable areas that do not interfere with tourism have already been licensed and adding more collectors would only put unnecessary stress on the industry and environment. In addition to this, Fisheries should require that all participants acquire the necessary skills and facilities to properly maintain the live organisms in good health and safety during shipments to minimize any waste.

## **LAND DEVELOPMENT AND FORESTRY**

These two subjects can easily be grouped together because the effect they have on the environment is similar in many ways. Accounting for (some) 80% of all marine pollution, land-based sources include coastal development, agricultural practices, industrial activities and inland deforestation. According to a recently published report (Reefs at Risk, 1998) by the World Resource Institute, land based pollution from coastal development, inland pollution and erosion are among the greatest threats to reefs worldwide.

Although tourism and development are important to Fiji's growing economy, one of the greatest threats to our coral reef is human expansion and development.

Anytime land is cleared to develop tourism, housing, industry or roads we shift the soil leaving it exposed for potential runoff into the sea. Construction along the coast, farming upstream or logging in tropical forest causes soil to erode and rush downstream into the ocean and onto the coral reef. In addition, when we remove the trees from large areas in the highlands the soil becomes exposed and unprotected. As development continues to alter the landscape, the amount of freshwater runoff increases. This terrigenous runoff may carry large amount of sediment from land clearing areas, high levels of nutrients such as phosphorus and nitrogen from agricultural areas and septic systems, as well as many pollutants such as petroleum products or insecticides. Unnatural increases in the amount of nutrients from this runoff can enhance the growth of other reef organisms such as sponges and algae's which easily outcompete the corals for space and light in cloudy or muddy water caused by the sedimentation. Threats to coral reefs from coastal development are also exacerbated by the loss of coastal wetlands, particularly mangroves, which serve as buffer zones that absorb excess nutrients, sediments and pollutants from the coastal runoff.

#### Possible solutions:

Of all the topics I have covered thus far, this is the most overwhelming (in scope) to tackle. Largely due to the diversity of the impact and overall size of areas effected, there is no simple solution to this problem. We must adopt a systematic approach that addresses each area of concern. We must also promote water and coastal management programs which integrate land and sea-based activities into ecosystem-based management programs that will better address the negative impacts of land-based sources of pollution on the marine environment. Step by step, with careful planning, it is possible to initiate a comprehensive plan for coastal zone management.

Most importantly, Government must promote and enforce environmentally conscientious guidelines and building codes for coastal development. Environmental impact assessment must be carried out prior to any development in coastal zones. Government must also be willing to provide financial and technical support for the development and implementation of these guidelines. The financial support could be levied to the proposed developer of the project. Government must ensure that the management and development of these plans includes input from science, social and economic factors.

Ways must be found to minimize runoff from sewage disposal, deforestation, agriculture and development through best-use practices. There is also a need to

come up with a plan to protect our mangrove forest, especially in areas most effected by erosion and runoff.

With regard to harmful agricultural chemicals being used in close proximity to coastal zones or rivers we need to explore alternative methods (if possible) and set guidelines for their use.

It should be possible to draw from the knowledge and expertise of those in the field of coastal related activities in other developing countries and look for best examples of how solve or prevent such problems in Fiji.

## **SUMMARY AND OPINIONS**

The world of the coral reef has often been revered as our last frontier. While most people agree that we have an urgent need to protect and preserve this vast resource of marine biodiversity it is important to remember that human interaction with the sea is inevitable.

The aim of this paper has been to focus our attention on the coral reef and it's potential to benefit human existence in numerous ways. The priority has always been to find ways in which we can coexist with nature without degrading our ecosystem. I believe that it is possible to create a sustainable solution to all issues presented here wherein our environment is protected and the community gains from sustainable use.

With the implementation of our E.A.M.E.P. project we are committed to solicit public opinion and response to these various resource utilization issues, while raising the awareness of proper use of our oceans resources. It is the intention of E.A.M.E.P. to conduct a number of public sessions and invite written and oral submissions for discussion and debate. Our focus must be to promote the development and implementation of comprehensive, integrated coastal zone management and water resource management plans that minimize the potential impact of human activities. This would include urban infrastructure, industry, agriculture and forestry, tourism, population increases, health and sanitation, marine commerce, marine collection and site-specific local uses.

It is strongly recommended that the above users and groups begin working together to form a unified voice and common goals. The intention of this report is not to criticize any one group or activity but rather to gain an understanding of the purpose and value on all sides of the issue. In my opinion, sound economic growth must work in unison and consideration of the living world that we all share.

