

DATA SYNTHESIS AND DEVELOPMENT OF A BASIS FOR ZONING
OF THE VIRGIN ISLANDS BIOSPHERE RESERVE

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ABSTRACT

The Virgin Islands National Park was designated a Biosphere Reserve by Unesco in 1976 and dedicated in 1983. With funding from the National Park Service, the Virgin Islands Resource Management Cooperative (VIRMC) has undertaken a series of studies as part of the Biosphere Reserve Program. This report presents the results of two studies, carried out by the Eastern Caribbean Natural Area Management Program, a member of VIRMC, to synthesize data on (1) the relative size and distribution of marine habitats within the protected areas of the U.S. and British Virgin Islands, (2) marine resource use around St. John, and (3) marine resource issues identified by managers and users (Project I.2.7); and suggest a basis for zoning of the marine portions of the Virgin Islands Biosphere Reserve (Project I.2.9).

Data on the size and distribution of marine habitats of St. John, Buck Island (near St. Croix), and the proposed marine protected areas of the British Virgin Islands, indicate that the Reserve is fairly representative, although lagoon habitats are relatively scarce. Commercial uses of these habitats were determined by interviews and mapped. While fishing, snorkeling, and diving are relatively widespread around St. John, boating activities tend to concentrate in a few bays. The most heavily impacted bays are, in descending order, Cruz, Francis, Cinnamon, Maho, and Hawksnest. Resource users and managers are especially concerned about marine traffic and congestion along the northwest coast of St. John, especially in Francis and Maho Bays, congestion and pollution at Cruz Bay, and the need for improved protection of marine resources in general.

Since the Biosphere Reserve is presently coincident with the National Park, zoning could be based on (1) a "core zone" which would include the least altered areas of the National Park, receive the highest degree of protection, and be used exclusively for nonmanipulative research and training; (2) a "buffer zone" which would include the rest of the non-core areas within the National Park, receive some alteration, and be used for various kinds of research, education and training, tourism and recreation, and traditional fishing; and (3) a "zone of cooperation" which remains undelineated, changes according to the cooperative demonstration projects being undertaken, and includes a variety of sites for study, documentation, and adaptation of traditional resource uses; developing practical means for restoring degraded ecosystems; undertaking ecologically and socially sensitive resource development projects; and training related to the above.

It is recommended that zoning for the Biosphere Reserve be undertaken as part of the development of a management plan with full participation of resource users and relevant federal and territorial resource management agencies. In the meantime, activities should aim at resolving the more immediate resource issues. Highest priority should be accorded working with government and community groups to solve the difficult problems of pollution and congestion in the port of Cruz Bay, and to guide development in the Coral Bay area. Next in priority would be projects to improve resource protection in the more congested bays of the northwestern portion of St. John and to work with fishermen to stimulate the recovery of baitfish stocks.

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INTRODUCTION

The Virgin Islands National Park was designated a Biosphere Reserve by Unesco in 1976 and dedicated in 1983. It is part of an international network of areas, representative of the world's natural diversity, managed to develop and disseminate the knowledge, skills, and attitudes needed to attain the best long-term use of natural resources. Biosphere Reserve programs focus on a variety of activities in resource protection and development, research, education, and communication.

Biosphere Reserve activities should focus on both longer-term environmental questions and those aspects relevant to the immediate welfare of the community. The Virgin Islands Resource Management Cooperative (VIRMC), with funding from the National Park Service (NPS), is currently studying some of the longer-term environmental issues, such as monitoring of the health of reef and fish populations and the effects of different kinds of land use on marine environments. It is also studying how the Biosphere Reserve Program could best be structured to assist with the more immediate resource management concerns of the community.

The purpose of this report is to present the results of the VIRMC studies carried out by the Eastern Caribbean Natural Area Management Program (ECNAMP) to support management of the Virgin Islands Biosphere Reserve (VIBR). The studies assigned to ECNAMP had the following objectives:

Project I.2.7 - To prepare a report describing the basis for identifying and delineating marine management and use zones to carry out the multiple purposes of a Biosphere Reserve in the Virgin Islands.

Project I.2.9 - To graphically analyze and synthesize work already completed under VIRMC I, as a basis for deriving community-based objectives for management of the Biosphere Reserve and for zoning marine portions of the Reserve.

Project II.1 - To outline the major concepts necessary to manage and develop a Biosphere Reserve in the Virgin Islands.

These three projects have been consolidated into a single contract. It was thought that they had many elements in common, and that savings could be realized by carrying them out concurrently. Also, the author promoted the consolidation of the projects so that data analysis, interaction with the resource management community, and development of concepts for management of the Biosphere Reserve could be integrated into a single process. (In this paper, the "resource management community" means the resource managers, resource users, educators, researchers, administrators and politicians who use, or have responsibilities for, the renewable natural resources of St. John and surrounding coastal waters.) The preliminary data and biosphere reserve concepts were useful for stimulating discussions with resource users and managers, who in turn corrected preliminary data, and helped provide guidelines for a community-based approach to reserve management.

This report covers the the results of Projects I.2.7 and I.2.9; Project II.1 is covered in a separate report. The underlying assumptions concerning the objectives, institutional framework, and methods for the management of the Biosphere Reserve, presented in the report for Project II.1, are central to the issues discussed in this report.

METHODS

Extensive consultations and interviews, graphic techniques, and review of literature were the major methods employed in these projects, with the emphasis varying for each.

Data synthesis project

The synthesis of marine resource data (Project I.2.9) was originally to be done through graphic techniques alone. The marine habitats already mapped under VIRMC Projects I.1.1 and I.1.3 were to be remapped using a common digital mapping system so that quantitative comparisons could be made between St. John, Buck Island, and the proposed protected areas of the British Virgin Islands. However, on closer examination this proved not to be feasible for two main reasons - cost and the imprecision of the original maps. The digitized mapping system would have required a major investment, and no funds had been allocated for that purpose. It was also discovered on careful examination of the maps from Projects I.1.1 and I.1.3 that in several instances the boundaries between habitats could not be delineated. This ruled out accurate quantification of habitat types, except within general size classes.

An additional problem encountered was that although a common habitat classification system had been developed for Projects I.1.1, I.1.3, I.2.1 and I.2.2, some deviations from this system were made by the authors of each report. It was therefore impossible to compare all of the habitats of St. John (mapped by one group) with those of the BVI and Buck Island (mapped by another group). In view of these problems, it was decided to summarize the distribution of habitats in tabular form, as recorded by each group, and categorize the estimated area of each in terms of size classes. The size classes used were (1) less than 10 hectares, (2) 10 to 25 hectares, and (3) greater than 25 hectares. While not as accurate as originally expected, these data are still quite useful in showing the relative sizes and distribution of the marine habitats of the areas surveyed.

Information on the use and degradation of marine resources of St. John and surrounding platform area was synthesized in graphic form. Data were gathered from interviews with local resource managers and users, review of VIRMC I reports, and compilation of records of infractions occurring in the marine areas of the National Park. By noting those areas which receive the greatest number of different uses, the greatest volume of use, and show signs of degradation, it was possible to identify marine areas receiving the major impacts of human use.

The main local resource user groups identified were fishermen, dive and snorkel tour operators, boat charterers, and resident yachtsmen. Due to time

constraints, it was only possible to interview resource users based in St. John, but it is recognized that a large number of commercial users from St. Thomas and the British Virgin Islands also use the resources of St. John's coastal area, as well as close to one million tourists who pass through St. John each year.

The major resource managers are personnel of the Virgin Islands National Park, the Department of Conservation and Cultural Affairs (DCCA) Division of Fish and Wildlife and Division of Coastal Zone Management, and the Planning Office. Most have their offices on St. Thomas although their management responsibilities cover St. John.

A series of interviews was carried out with marine resource users on St. John. The first set was conducted by Consultant Stephen Koester, and included 53 individuals (28 fishermen, 5 dive tour operators, 9 charter boat operators, 5 private yachtsmen, and 6 government employees). A second set of interviews was conducted by the author with five individuals, representative of these groups, to check the accuracy of the marine resource issues and maps compiled from the first set of interviews. A third set of interviews was conducted by Consultant Elroy Henley of the St. John Administrator's Office to broaden the number of individuals and kinds of groups interviewed. These interviews were conducted one year after the first set, and resulted in some major differences coming to light. These differences may have stemmed from the one year time difference, the interview styles of the consultants, and/or the different individuals interviewed. Henley interviewed taxi drivers and hotel and guest house managers, as well as additional dive, tour, and charter boat operators, resident yachtsmen, and fishermen.

Most of the interviews with resource managers, educators, and administrators were carried out by the author, and included 14 individuals (5 from DCCA, 3 from NPS, 3 from Planning, 2 from the College of the Virgin Islands, and 1 from the St. John Administrator's Office). Group meetings were also held with NPS employees (three separate meetings) and DCCA Division of Fish and Wildlife staff. A meeting of St. John fishermen, NPS representatives, and the British Virgin Islands Fisheries Officer was organized by Koester. Representatives of the other user or manager groups were met individually.

Data on the major marine resource issues of St. John were compiled from the meetings and interviews with the major marine resource user and manager groups, presented both in tabular and narrative form, and reviewed with representatives of each group.

Development of a basis for zoning

A basis for zoning of the marine portion of the Biosphere Reserve (Project I.2.7) was sought through a review of literature, interviews with resource managers and users, and analysis of the data gathered and synthesized under Project I.2.9.

RESULTS AND CONCLUSIONS

Data synthesis, Project I.2.9

To manage the marine resources of the VIBR, it is necessary to understand their distribution and use. Considerable work was undertaken during the first year of VIRMC activities to do this. Data on the distribution, use, and degradation of marine resources of St. John and surrounding areas have been synthesized in map and tabular form. Information on the major marine resource issues confronting users and managers alike has been described narratively and summarized in tabular form.

Size and distribution of marine habitats. In order to determine whether the presently constituted Biosphere Reserve (superimposed on the Virgin Islands National Park) is generally representative of the marine habitats of the region, it is necessary to determine the size and distribution of the marine habitats within the declared Reserve, and compare them with the coastal marine areas of St. John outside the Reserve and with the other marine protected areas of the U.S. and British Virgin Islands.

A system for classifying the marine habitats of the Virgin Islands was developed for all VIRMC Projects and is indicated in Table 1. The full 35 categories were used for mapping in the British Virgin Islands and St. Croix. Around St. John, however, only 28 of the 35 categories were used.

The size and distribution of these habitats, mapped through VIRMC projects, is indicated in Table 2. It should be noted, however, that the maps which form the basis for these data often overlap, as shown in Figure 1. Thus, some areas occur in two different maps. The names which appear on the left side of Table 2 refer to the general map areas shown in Figure 1 and not to a specific geographical location. For example, part of Cruz Bay and Honeymoon Bay are included in the map referred to as "Caneel Bay".

From Table 2 it can be seen that, as interpreted by the team members of Project I.1.3, the Biosphere Reserve/National Park contains all of the marine habitats mapped by both teams, although the lagoon habitats occur only in Reef Bay. The members of the two mapping teams also interpreted the following habitats as being relatively rare:

- Shallow bay mud (SBm), found at Mary's Creek and Cruz Bay, St. John.
- Gorgonian reef (Rgo), found near Mosquito Island, BVI; and off Trunk Bay, Whistling Cay, and Hawksnest Bay, St. John.

Thus, it appears that the Biosphere Reserve, as presently designated, is fairly representative of the nearshore marine habitats of the Virgin Islands. It is clear, however, that the assemblages and sizes of habitats are quite different for the protected areas of St. John, Buck Island off St. Croix, and the proposed protected areas of the British Virgin Islands.

Table 1. Classification of marine habitats
(source: modified after Gladfelter et al., 1984)

A) Shore Zone	S
1) Beach rock	Sb
2) Sand	Ss
3) Mangrove	Sm
4) Pavement	Sp
5) Gravel/cobble	Sg
6) Bedrock	Sbr
B) Subtidal Bedrock	SR
C) Lagoon	L
1) Sand	Ls
2) Pavement	Lp
3) Grassbed	Lg
4) Patch reef	Lpr
D) Shallow Bay	SB
1) Sand	SBs
2) Pavement	SBp
3) Grassbed	SBg
4) Patch reef	SBpr
5) Mud	SBm
6) Algae	SBa
E) Reef (fringing and barrier)	R
1) Backreef	Rb
2) Reef crest	Rc
3) Forereef	Rf
4) Sand	Rs
5) Gorgonian reef	Rgo
6) Pavement	Rp
F) Bank	B
1) Gorgonian coral flat	Bgo
2) Pavement	Bp
3) Sand	Bs
4) Grassbed	Bg
5) Patch reef	Bpr
6) Bank reef (linear aspect)	Br
7) Algal plain	Ba

Table 2 (Continued). Representation of marine habitats, protected areas of the Virgin Islands

Location	Shore Zone				Bed-rock	Lagoon			Shallow Bay							Reef					Bank							
	S	Se	Sm	Sg		SR	L	Lp	Lg	SB	SBS	SBP	SBSBpr	SBS	SBa	R	Rb	Rc	Rf	Re	Rgd	B	Bgo	Bp	Bs	Bg	Bpr	Ba
<u>USVI</u>																												
<u>National Park</u>																												
Cinnamon Bay	A1	A1		A1	A1				C3	C3	A2	C3	A1		C2		A1	C1	B2	C1	C3				C3	C3	C1	
Francis Bay	A1	A1		A1	B1				C3	C3	B1	B1	A1		C1			C1	A1	B1	C2	B1	A2					
Leinster Bay	B1	A1	A1	A1	A1				C2	C3	B1	B2		A2	A1	A1		A2			C3	B1	A1	C3				
Brown Bay	A1	A1		A1	A1				C3	A1	A1	C3			B2			B2			C3	B3		A1	C3			
Round Bay	A1	A1	A1	A1	A1				A1	A1	A1				B2	A2	A1	B2			C3	A2	A1	C3				B1
Caneel Bay	B1	A1	A1	A1	B1				C2	A1	C1	B2			A1			A1			C3	C2		C3	A1			
Drunk Bay	A1	A1		A1	B1				B2	A2	B2	A2			A2			A2			C2	A1	B2	C3	B2			
Lameshur Bay	B1	A1	A1	A1	B1				C3	B2	B1	C3	?		B1		A1	B1			C3	A1	A2	A2	C3	A1		
Reef Bay	A1	A1			A1	A1	A1	A1	A2	A1	A1	A2		A1	C1	A1	B1	C1			C2	A1	A1	B2	C2	A1	B2	
Hawksnest Bay	A1	A1			A1				C3	A2		B3	A1		B2		B2			A1	C3	C3		C3				
<u>St. John (outside of National Park)</u>																												
Lameshur Bay																												
Reef Bay	A1	A1	A1	A1	A1				C2	A1	A2	B2		A1	A2		A2			C3					C3			B2
Coral Bay	B1	A1	B1	A1	B1				C2	C3	B1	C1	A1		A1	B1		B1										
Johnson Bay	A1	A1	A1	A1	A1			A1	A1	A2	A2	C2			C2	A1	A1	C2										
Chocolate Hole	A1	A1			B1				C3	B2	B1	C3			B1		A1	B1			C2		B2	A2			B1	
Cruz Bay	A1	A1	A1	A1	B1				B1	A1	A1	A1			C1			C1	A1		C3				B2	C3	A1	
Caneel Bay	A1	A1	A1	A1	A1				B1	A1	A1	A1		A1	A1	A1					C3	A1		C3				A1

A = less than 100,000 m²
 B = 100,000-250,000 m²
 C = greater than 250,000 m²

1 = zone boundaries well defined
 2 = some zone boundaries undefined
 3 = many zone boundaries undefined

Table 2 (Continued). Representation of marine habitats, protected areas of the Virgin Islands

Location	Shore Zone			Bed-rock	Lagoon		Shallow Bay						Reef						Bank									
	S	Sa	Sm		Sg	SR	L	Lp	Lg	SB	SBa	SBp	SBg	Sbpr	SBm	SBr	Rb	Rc	Rf	Rs	Rgd	B	Bgd	Bp	Bs	Bg	Bpr	Ba
Round Bay	C1	A1	A1	B2					C2	A1	C2	B2	B1			C2	A1	A1	C2		C3		A2	C3			C2	
Drunk Bay	A1	A1		A1	A1	A1	A1	A1	A1	A1	A1				C2	A1	A1	C2		C3		C1	C3	B1	A1			
East End	A1	A1		A1	B2				B1				B1		C2		C2				C3	B1		C3		A1		

Shore Zone			Bed-rock	Lagoon			Shallow Bay					Reef					Bank																	
S	Sb	Ss	Sm	Sp	Sg	Sbr	SR	L	La	Lp	Lg	Lpr	SB	Sbs	Sbp	SBg	Sbrp	Sbm	Sbsr	R	Rb	Rc	Rf	Rs	Rgp	B	Bgd	Bp	Bs	Bg	Bpr	Bs	Ba	
St. Croix																																		
Buck Island			B1	A1	A1																													

A = less than 100,000 m²
 B = 100,000-250,000 m²
 C = greater than 250,000 m²

1 = zone boundaries well defined
 2 = some zone boundaries undefined
 3 = many zone boundaries undefined

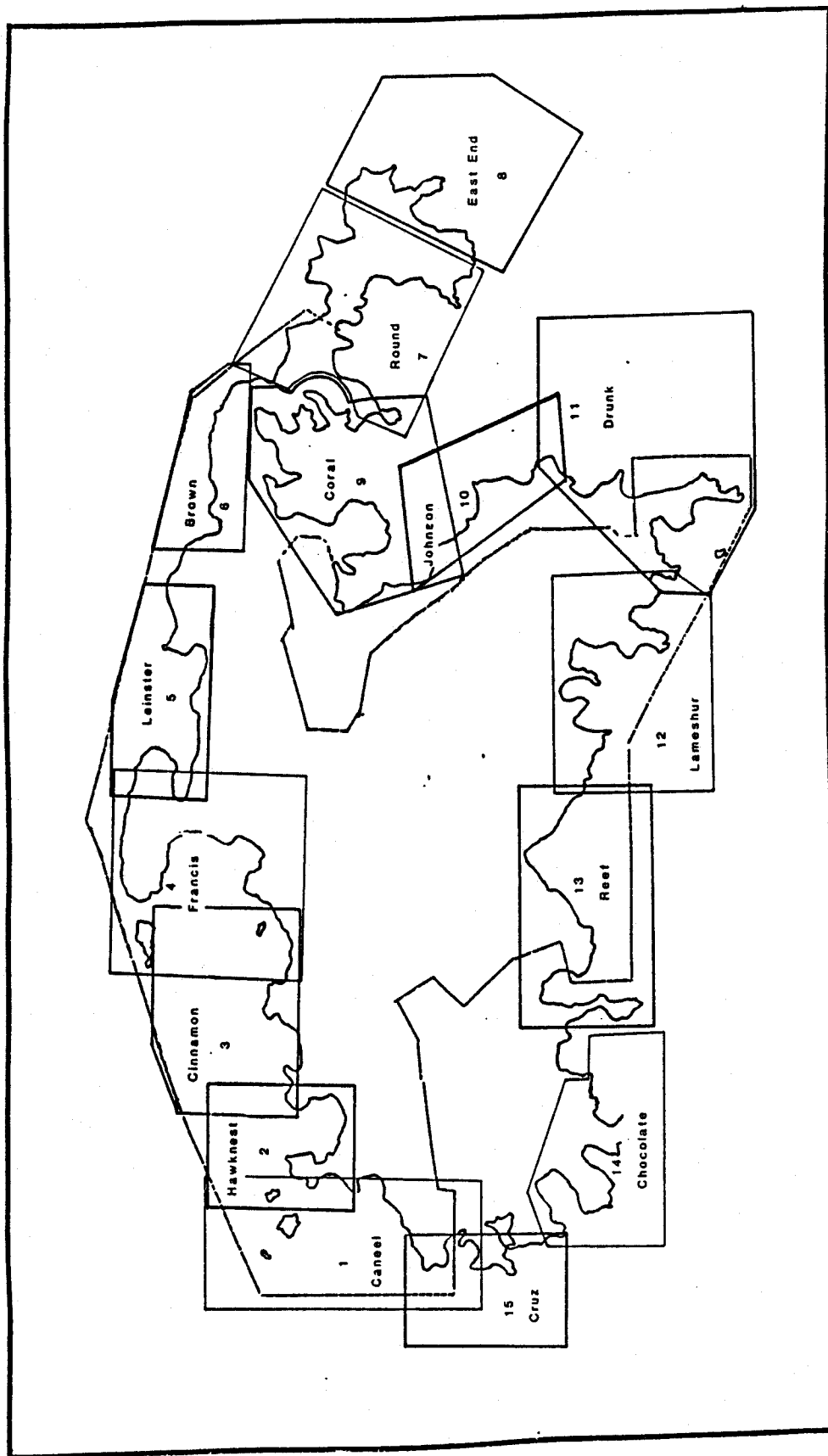


Figure 1: Areas Mapped for Marine Habitat

Resource use. The patterns of marine resource use around St. John are presented in the map series of Figure 2, but the information is limited. Maps 2.2 through 2.4 only indicate the distribution of use. In the absence of quantitative data, only estimates of frequency of use can be made (i.e., maps 2.5 and 2.7).

Marine resource users of St. John use not only the coastal areas of St. John but the surrounding islands and cays as well, as shown in the location map (Figure 2.0). However, consistent information on resource use was only collected for the St. John coastal area shown in Figure 2.1. Fishing, diving, and snorkeling activities are relatively widespread (Figures 2.2 and 2.3), while boating activities tend to concentrate in a few bays (Figure 2.4). The distribution of marine infractions within the National Park from November 1973 to December 1984 is indicated in Figure 2.5, and actual damage to marine resources observed by VIRMC Project I.1.1 members during habitat mapping is shown in Figure 2.6. These uses and abuses of the marine resources are synthesized in Figure 2.7. The most heavily impacted bays would seem to be Cinnamon and Francis Bays, with Hawksnest and Maho Bays close behind. These are all within the boundaries of the Biosphere Reserve/National Park. The heavy commercial use of Cruz Bay as a port also causes it to be heavily impacted, but these uses were not included in the mapping exercise.

Marine resource issues. The major commercial users of St. John's marine resources were interviewed by Koester during April 1985. The issues of greatest concern to them are described in Appendix I and summarized in Table 3. Follow-up interviews conducted by Henley one year later led to different conclusions, which are presented in Table 4. For example, while Koester found fishermen deeply concerned about pot theft, Henley found it to be only a minor irritant. Koester found all groups put off by the law enforcement emphasis of the National Park Service, but Henley did not find this to be a concern voiced by the users he interviewed. In fact, some persons interviewed by him thought that more regulation was necessary to protect the resources in some of the more congested bays.

In spite of the differences regarding marine resource issues found by the two consultants, it is evident from the interviews, especially among users with commercial interests, that there is widespread recognition of, and concern for, the heavy and varied use of coastal marine resources. Most realize the need for **increased resource protection** and note that many corrective measures could be implemented without major cost. Many emphasize, however, that corrective measures would require close cooperation among resource managers and users.

The National Park Service's resource management strategy seems to have shifted from provision of information (e.g., meetings with user groups, informal discussions with individual users, brochures and signboards informing visitors of regulations, notations on navigational charts, informal training of tour operators) and infrastructure (e.g., marker buoys, permanent moorings) to a greater reliance on law enforcement. This shift has reduced opportunities for interaction with, and participation of, resource users in management decisions, and could prove to be a stumbling block to resolving resource

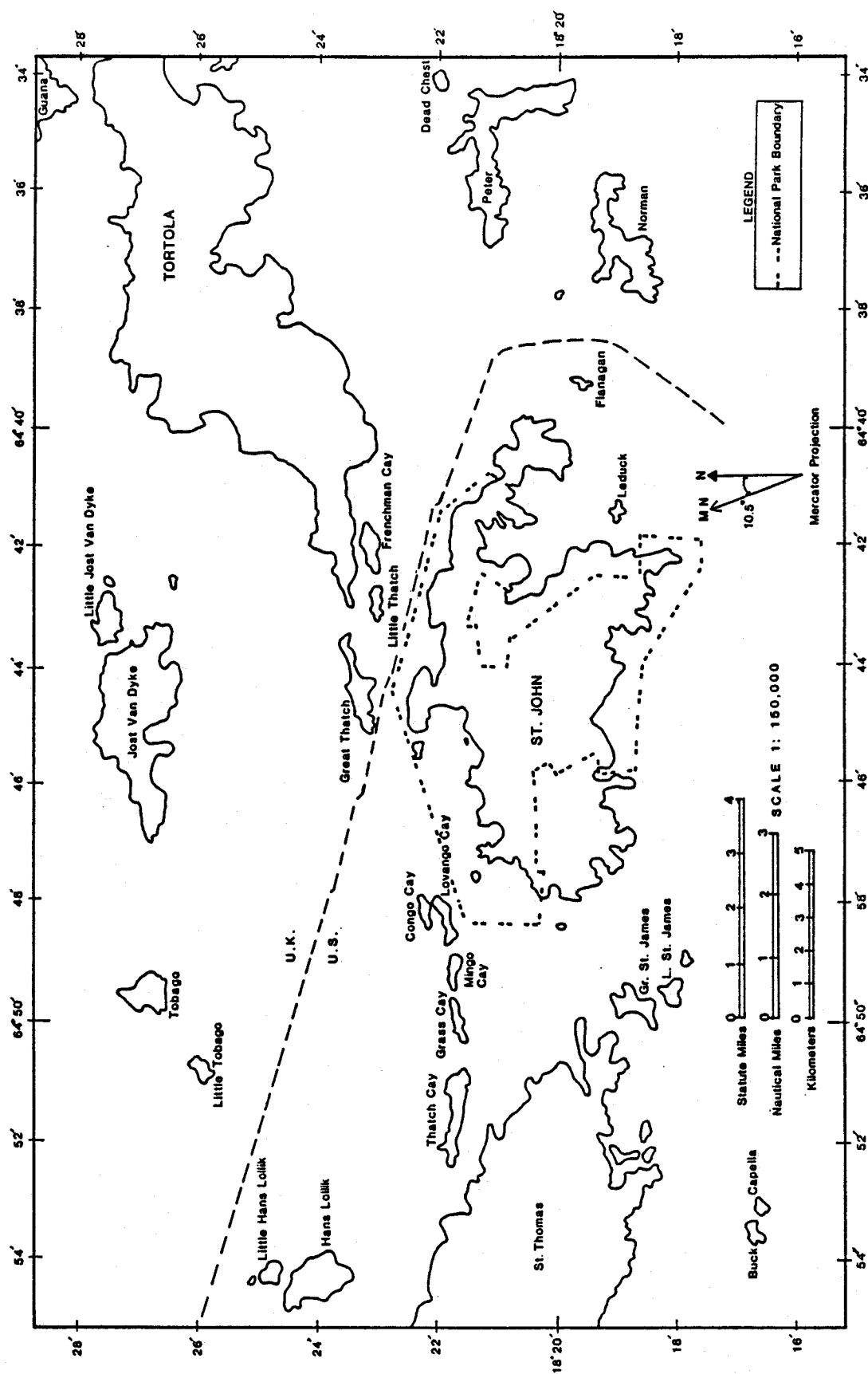


Figure 2.0: Location Map, St John (Source: Modified After NOAA, 1972)

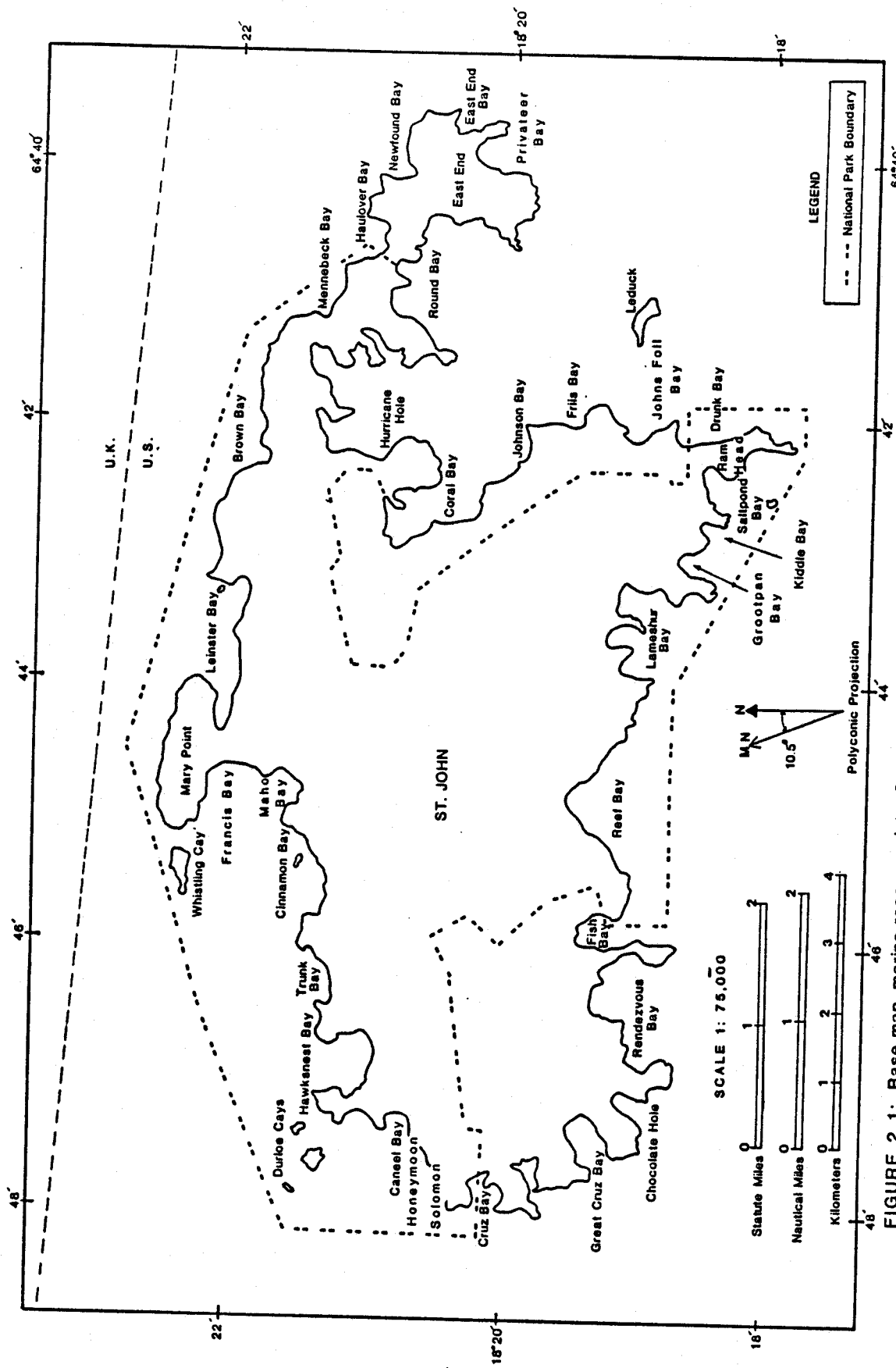


FIGURE 2 1: Base map, marine resource data, St. John coastal area (source: modified after Geological Survey, 1982)

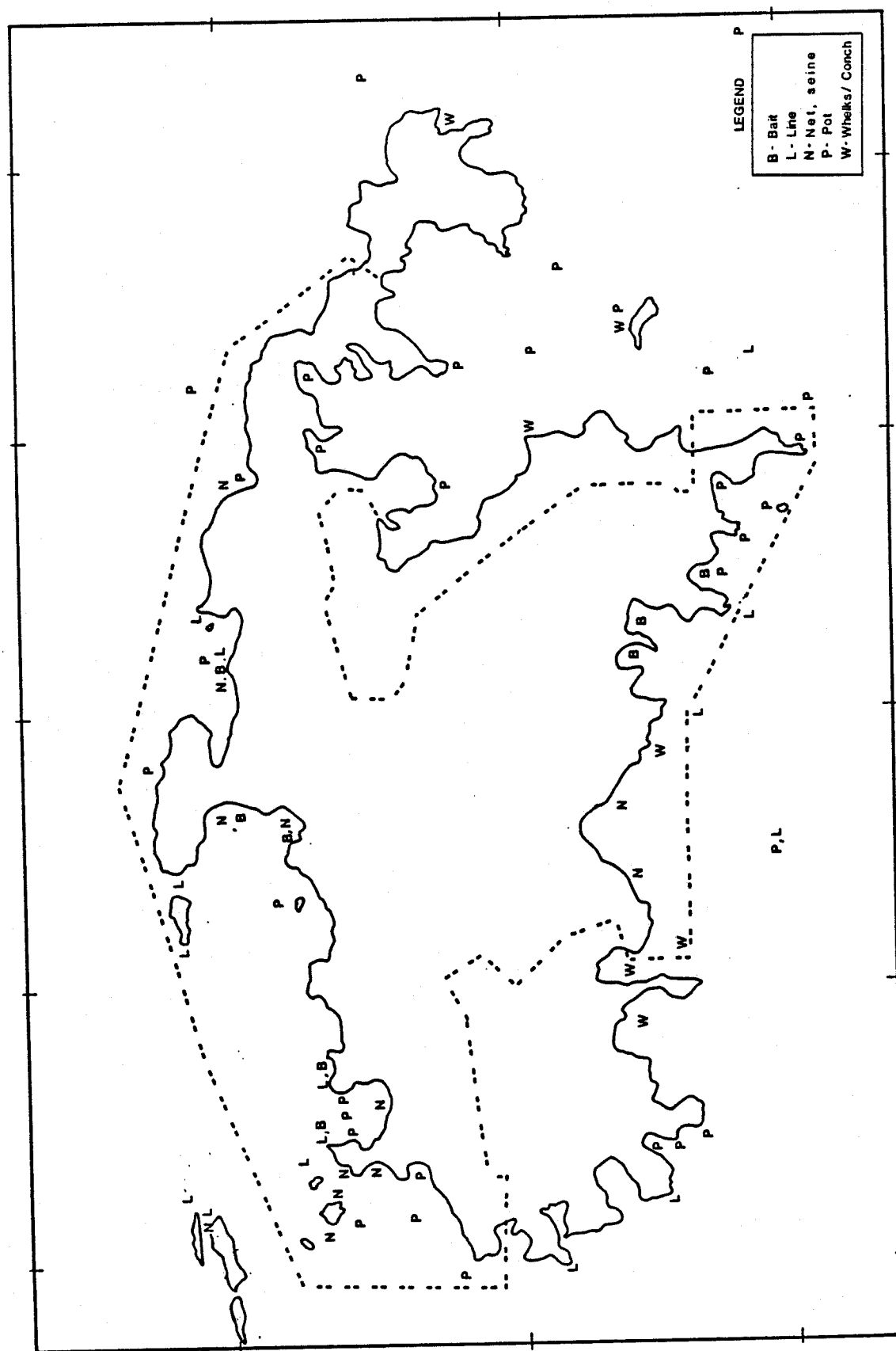


FIGURE 2.2: Fishing (source: Koester, 1985)

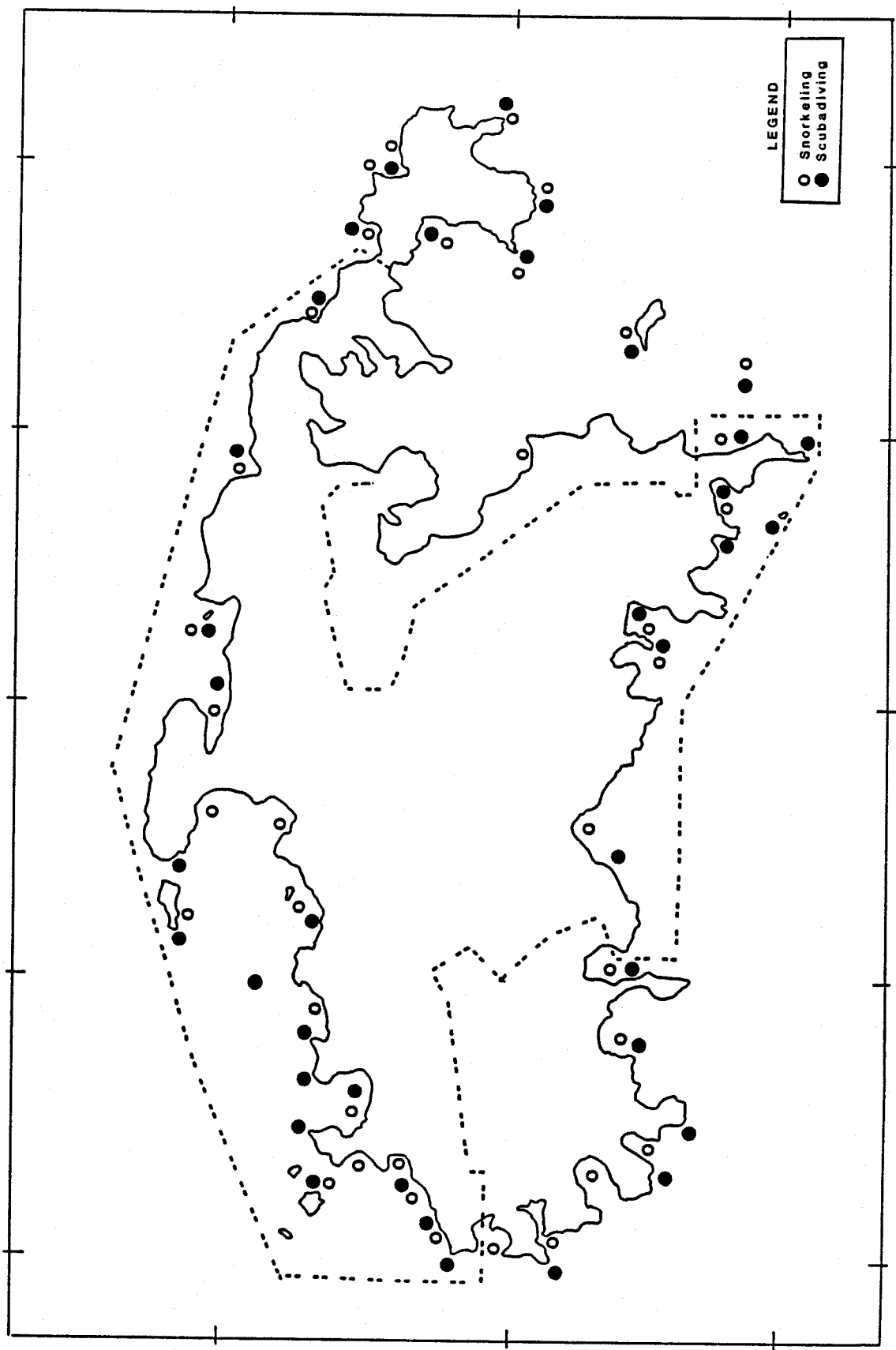


FIGURE 2.3: Snorkeling and Diving (source: Henley, 1986 - Koester, 1985)

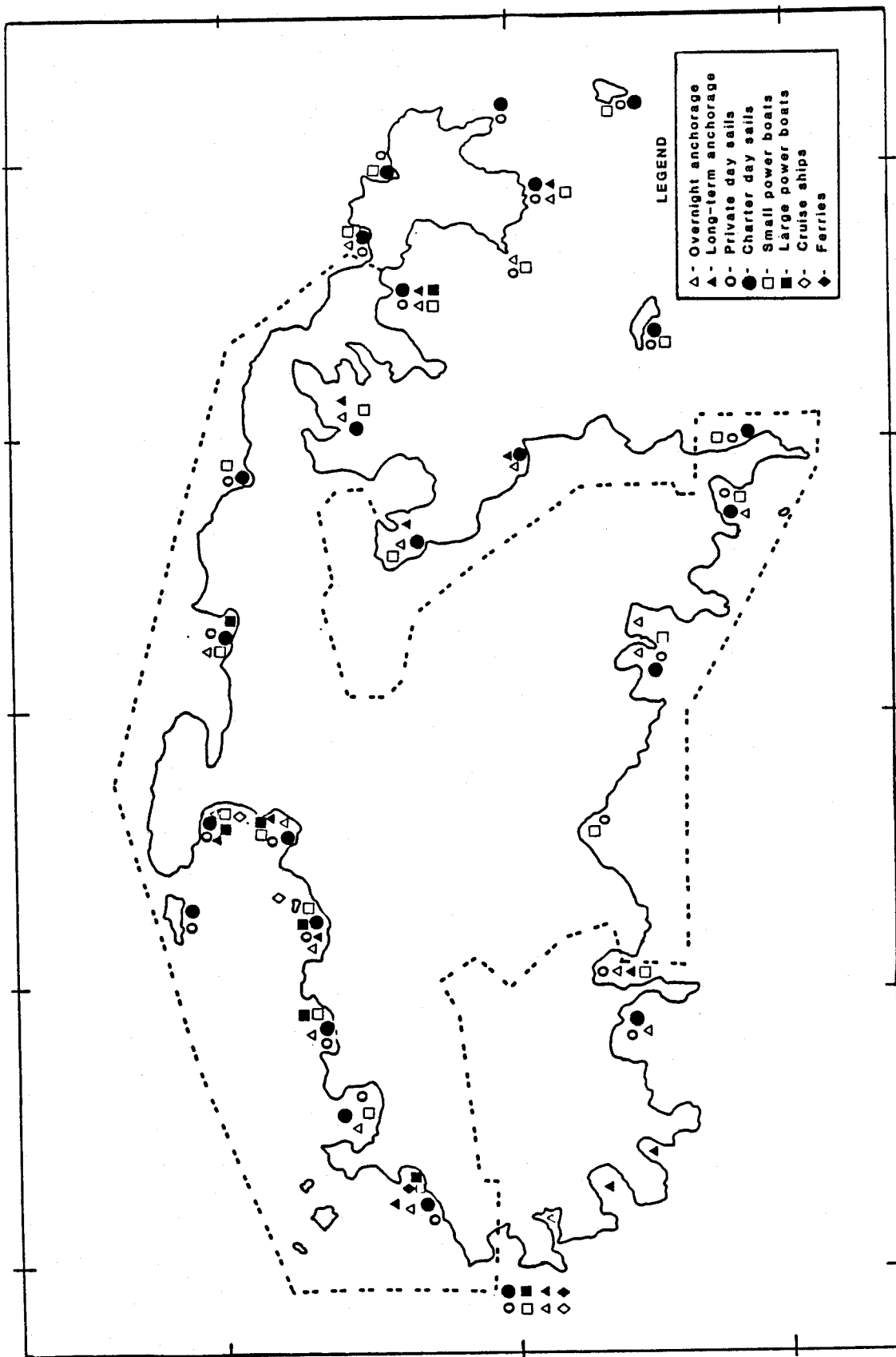


FIGURE 2 4: Boating (source: Henley, 1986)

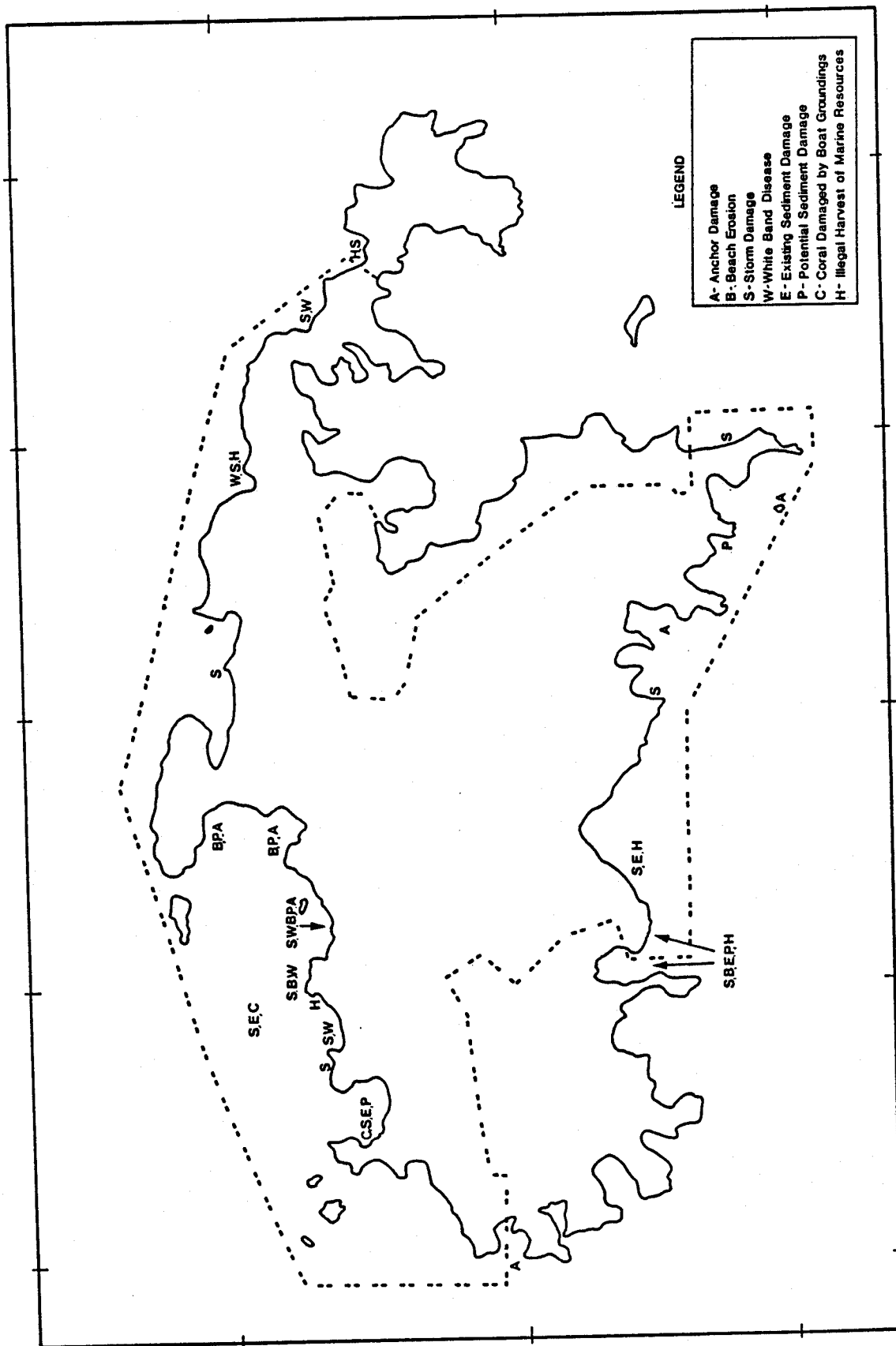


FIGURE 2.6: Degradation of Marine Resources (source: Beets and Lewand, 1984)

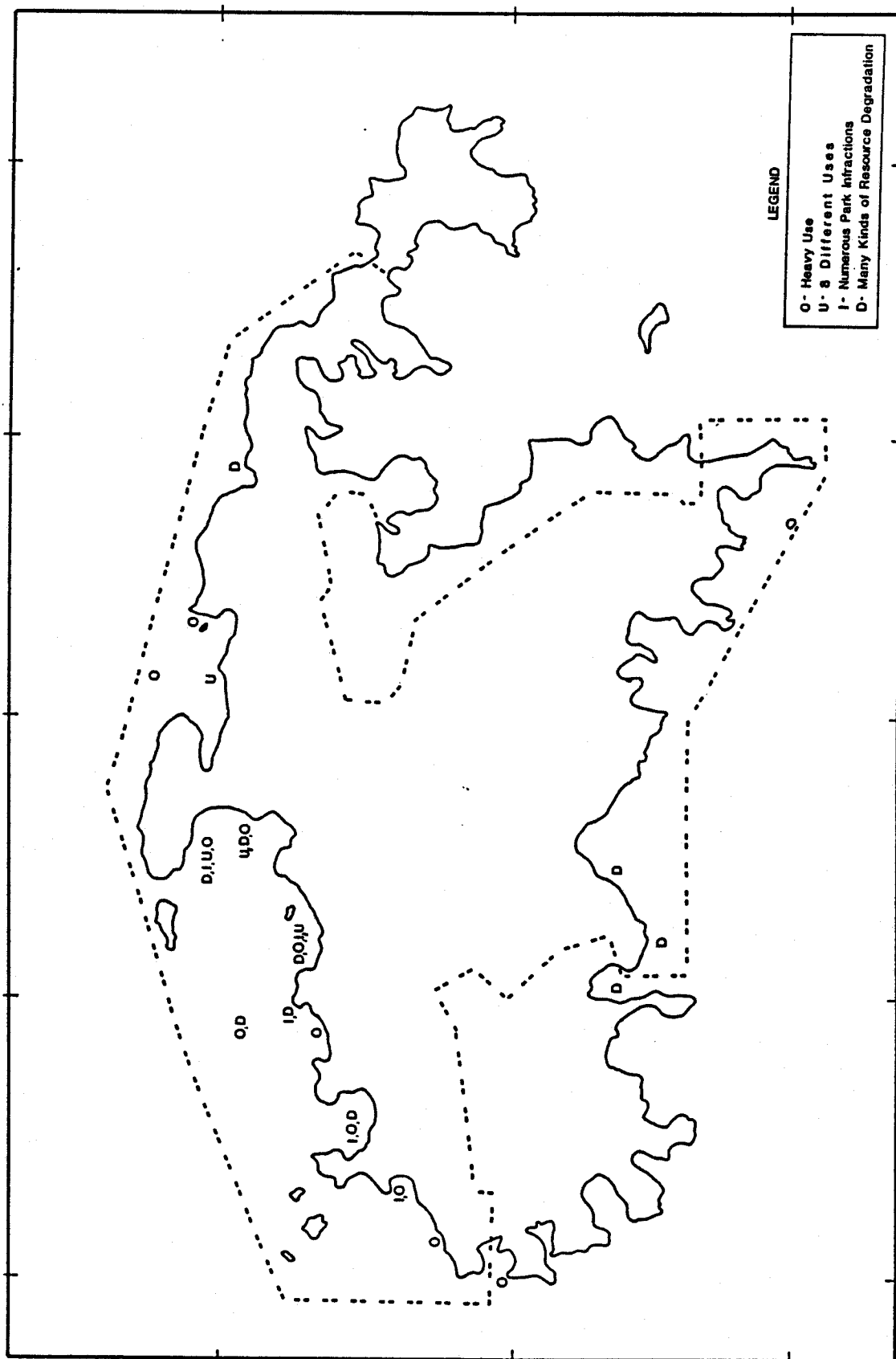


FIGURE 2.7: Synthesis, marine resource use

Table 3. Summary of issues identified by Koester

ISSUE	FISHERMEN	BOAT AND SAIL CHARTERS	DIVE AND SNORKEL OPERATORS
Fish Traps	1. Theft of traps. 2. Theft of fish from traps. 3. Divers opening or cutting pots to release fish. 4. Confusion over DCCA regulation color coding traps and dissatisfaction with regulation prohibiting unmarked traps.	1. White buoys are very difficult to see. 2. Traps set in major traffic areas. 3. Trap lines catch props. 4. Fish traps taking all the reef fish.	1. Inconsistent to have strict regulations on spearfishing but not traps. 2. Traps over fishing reefs, many unmarked traps. Also ghost traps. 3. Accusations of stolen traps unfair; many taken by current.
BVI Customs and Fishing Permits	1. "Catch-22": you need a permit to fish BVI waters but BVI is not issuing them. 2. Confusion over BVI fishing regulations. 3. Fishing being restricted by an imaginary line that is illogical ecologically and culturally.	1. BVI Customs a major problem. Increased cost and time wasted are keeping day charters away from BVI, increasing use of USVI (St. John).	1. Impractical, expensive, and time consuming to go through Customs to do a dive tour. Situation has become increasingly troublesome for dive and daysail operators. Only practical way to go is not to clear customs. Has been made more risky with recent acquisition of two high-speed boats by Customs.
Anchor Damage	Not an issue.	1. Damage to reefs widespread and steadily increasing.	1. Damage to reefs extensive. 2. Danger from boats dropping anchors over submerged divers.

Table 3 (Continued). Summary of issues identified by Koester

ISSUE	FISHERMEN	BOAT AND SAIL CHARTERS	DIVE AND SNORKEL OPERATORS
Overuse	1. Recognize environment over-exploited; sometimes suggest overfishing. 2. Noticeable decrease in fish in all their time fishing (whether 55 or 25 years of age). 3. Increase in boat traffic (as possible reason for decline in fish). 4. Intensification of fishing techniques (as possible reason). 5. Increase in number of tourists and related activities.	1. Rapid increase in use due to increased tourism, speed of boats allowing people to venture farther, high use areas formerly contained but now easily reached. 2. Christmas Cove, Green Cay, Trunk Bay all way overused. 3. Tendency of charter operators to "bunch up" (charters go to the same places) adding to the problem.	1. High number of day charters from St. Thomas and St. John using Park. 2. North side of St. John diving areas diminished in quality. Operators do not recommend people snorkel at Trunk Bay. 3. Recent increased use of Salt Pond Bay has diminished its use for diving and snorkeling. 4. Other adversely impacted dive sites: Johnson's Reef, Devers Bay, Two Brothers, north side Congo Cay. 5. Salt Island, wreck of the Rhone, very heavily used. 6. Use of Eagle Shoal by divers rapidly increasing. 7. "St. John waters inshore are poor diving areas."
Communication with Officials	1. Want more explanation regarding regulations and the reasons for them.	1. Some have excellent rapport, others do not; no agreement on this issue.	

Table 3 (Continued). Summary of issues identified by Koester

ISSUE	FISHERMEN	BOAT AND SAIL CHARTERS	DIVE AND SNORKEL OPERATORS
NPS Enforce-ment	1. Rangers unfriendly towards local fishermen. 2. Harrassment by rangers; needlessly approach fishermen's boats while fishing.	1. Park approach is not educational. 2. Rangers rely on force rather than discussion and reason.	1. "Park has a tendency to overplay their role - no reason that they should carry guns down here - they come on really strong."
Marine Traffic	1. Heavy marine traffic may be partly responsible for pot losses along north shore of island and between east end of St. John and Norman Island. 2. Increase in yachts anchored in bays has made obtaining bait more difficult.	1. Heavy traffic in all north shore bays, esp. by St. Thomas day charters. 2. Generally heavy traffic between St. John and Tortola, seaplane landing area (Cruz Bay), the Creek, Cow and Calf, Christmas Cove. Harbors very crowded.	1. Pillsbury Sound "like a highway and St. John is a roadside stop for all the St. Thomas to Tortola traffic." 2. Lind Point marine traffic particularly heavy. 3. Norman Island.
Marine Traffic (Clipper Ships)	Clipper ships not mentioned.	1. Nantucket Clipper, Newport Clipper, Caribbean Princess (mini cruise ships) now entering bays formerly used by yachts: Round Bay, Maho, Francis. 2. Entering Norman Island, Jost van Dyke. Keep lights on and generators running all night.	1. Clipper ships (8 foot drafts) will come into Coral Bay next year; anchors huge, when dragged across sand cause turbidity and siltation. Bilge also a problem. In Maho Bay occurs close to best snorkeling area.

Table 3 (Continued). Summary of issues identified by Koester

ISSUE	FISHERMEN	BOAT AND SAIL CHARTERS	DIVE AND SNORKEL OPERATORS
Marine Traffic (Ferries)	Not mentioned.	1. Have taken over public dock in Cruz Bay; yachts cannot tie up. 2. Yachts have had moorings and anchors ripped out by ferries in Cruz Bay. 3. Go too fast in harbor no-wake zone, creating a wake. 4. Ferry wake on North Shore contributes to beach erosion.	1. Impact of ferry bilge on environment.

Table 4. Summary of issues identified by Henley

ISSUE	FISHERMEN	BOAT AND SAIL CHARTERS	DIVE AND SNORKEL OPERATORS
Fish Traps	1. Theft of a small percentage of traps by non-St. Johnians. 2. Difficulty acquiring bait; curious tourists scare fish away by swimming close to observe casting of nets. 3. Due to decline in inshore fish stocks, pots are being set in deeper waters.	1. White buoys are very difficult to see. 2. Excessive rope floating from fish traps catches props. 3. Mesh size of pots should be decreased. 4. Pots should not be set on reefs directly.	1. Traps not visible enough. 2. Traps should not be placed around reefs. 3. Traps should be rotated on a seasonal basis.
BVI Customs and Fishing Permits	1. BVI fishermen fish alongside St. Johnians in both BVI and US waters without problem. 2. BVI fishermen supply 95% of fish sold in St. John. 3. No indication of any problems from BVI officials.	1. No problem clearing customs in BVI. 2. West End Customs Officers more efficient than Officers in Road Town.	1. Suggest that clearing be allowed on a weekly basis for regularly scheduled trips. 2. Knowing Customs Officials can often speed process.
Anchor Damage	Not an issue.	Not an issue.	1. Not commonly seen except in Maho and Francis Bays.
Overuse	1. Fish reproduction areas such as mangroves have been contaminated by wastes from boats in long-term anchorage. 2. Increases in marine traffic have caused fishermen to move to deeper waters. 3. Fish stocks declining.	1. Congestion a problem in only a few areas. Better management needed in these areas. 2. Bare boat charters cause greatest problems.	1. Bare boat charters cause greatest problems. 2. Tour operators need to better inform clients of local customs and regulations regarding use of resources.

Table 4 (Continued). Summary of issues identified by Henley

ISSUE	FISHERMEN	BOAT AND SAIL CHARTERS	DIVE AND SNORKEL OPERATORS
Communi- cation with Officials	1. No information distributed by regulating agencies (NPS, DCCA). 2. Infrequent encounters with personnel of regulating agencies.	Not an issue.	1. No regulatory information distributed. 2. Regulatory agencies should be more active in managing resources.
NPS Enforce- ment	1. Rangers seldom seen. 2. Problems with a couple of cases where too many conch or whelks had been harvested.	1. Good relationships. 2. Few encounters with rangers.	1. Few encounters with rangers. 2. Good relationship.
Marine Traffic	1. Heavy marine traffic is ruining previously depend- able fishing banks. 2. Heavy traffic is scaring bait. 3. Small percentage of lost pots due to marine traffic.	1. Some congestion within some bays, especially Cruz Bay. 2. Very heavy traffic for day sails in Hawksnest Bay. 3. Boats from Puerto Rico cause alot of noise in Maho and Francis Bays.	1. Cruz Bay dock area very congested. 2. Cruz Bay cargo area very congested. 3. Noise level of boats from Puerto Rico excessive.
Marine Traffic (Clipper Ships)	Not an issue.	1. Overnighting of mini cruise ships creates excessive noise; running of generators makes entire bay vibrate.	1. Cause anchor damage in Francis/Maho Bays. 2. Should anchor offshore and use dinghies to bring passengers to shore.

Table 4 (Continued). Summary of issues identified by Henley

ISSUE	FISHERMEN	BOAT AND SAIL CHARTERS	DIVE AND SNORKEL OPERATORS
Marine Traffic (Ferries)	Not an issue.	1. Congestion at public dock, Customs, and at Park Service dock at Cruz Bay.	1. Refueling spills at National Park dock degrade environment. 2. Ferries approach harbor with too much speed.

issues, or indeed, for involving the community in developing and managing a Biosphere Reserve. Yet the general awareness of the intensity of resource use and interaction among users on St. John is such that the need for improved management is widely recognized. With improved communication, **consensus could be developed to identify and prioritize management measures, to clarify the proper role of law enforcement, and to enlist balanced cooperation among managers and users.**

As a start on improving the protection of resources, highest priority is given to initiating a project to find solutions to the difficult problems of congestion and pollution in Cruz Bay. This would require cooperation among a large number of governmental agencies, both federal and territorial, community organizations, interest groups, and individuals. At the same time, it would involve large numbers of individuals and institutions in the Biosphere Reserve Program. If successful, these activities would provide good lessons for dealing with the congestion of the other bays on the northwestern side of St. John, especially Francis and Maho Bays, the most congested.

One issue of particular relevance to the outreach aspects of the Reserve Program is the **style and degree of development to be sought for St. John's eastern end.** Commercial development has until recently concentrated on the western side, and the National Park dominates land use in the central portion. Traditional means of livelihood still survive to some degree on the eastern side. However, increasing use of the island is focusing interest on this relatively undeveloped area. There is concern that development be planned and directed to strike a balance between the all-out and uncoordinated development on the western side, and nearly complete protection, as in the National Park. The opportunity to plan the development of the east end, drawing on the experiences and mistakes from development on the rest of the island, still exists.

An issue of particular concern to fishermen is the alarming reduction in stocks of baitfish (fry) which are caught in the shallow waters of bays with sand bottoms. Fishermen must now go long distances to small cays in the British Virgin Islands to catch baitfish, and this has had a major effect on fishing around St. John. Working with the fishermen, research is needed to determine the cause of this reduction in stocks and to seek viable solutions.

Among resource managers, **carrying capacity of the inshore marine resources** of St. John is the major issue of concern. There is a growing perception that in some bays the combination of fisheries and tourism uses is near the limit of the resources' carrying capacity under the present management regime. Managers favor experimentation with the installation and required use of moorings in the most popular anchorages, thereby hoping to establish an enforceable limit to yachts and tour boats. They also favor experimentation with rotating closures of bays to fishing. There is a recognition, however, that these new measures, especially fishing closures, could, unless handled with extreme care, be unpopular among users.

Basis for zoning, marine areas

Several approaches to identifying and delineating marine management and use zones to carry out the multiple purposes of a biosphere reserve in the Virgin Islands are theoretically possible. For example, using a modification of the Biosphere Reserve zoning scheme recommended by Batisse (1986), the following marine use zones could be delineated:

1. **Core Zone** - Managed for minimum human interference to serve as a baseline for the ecological region. Research, monitoring, educational and training activities are carefully controlled and must be nonmanipulative. This zone consists of the main ecosystem or ecosystems to be protected. It should be large enough to be self-sustaining and surrounded if at all possible by a "buffer" area to screen it from surrounding forms of resource use. In the Virgin Islands context, and focusing on marine resources, this zone would be selected from the least altered marine areas within the National Park.

2. **Buffer Zone** - Managed for research, education and training activities. This zone consists of the same ecosystems as the Core Zone which have been or could be modified by different types of resource use. The research and monitoring activities can be both basic and applied, manipulative and nonmanipulative. Research and monitoring are environmentally oriented but also focus on social, economic, and cultural parameters as necessary. One or more direct types of resource use (i.e., tourism, fisheries, mariculture) are studied to develop, demonstrate, and promote appropriate practices. These uses must be carefully selected and designed to avoid major negative impacts in any sizeable portion of the zone. This zone ideally surrounds the Core Zone, acting as a buffer. It often will be necessary to establish subzones because of the multiple uses. In general the more manipulative techniques and methods and direct resource uses should be as far from the Core Zone as possible. For the marine areas of the Virgin Islands Biosphere Reserve, this area would consist of those waters and cays within the boundaries of the National Park surrounding the core zones. Within this buffer zone, specific restoration subzones could be identified and managed to reclaim natural resources where natural or human-caused alterations have passed ecological thresholds, where biological processes have been interrupted, or where species have become locally extinct. This subzone would provide a focus for experiments in rehabilitation. Small portions could be retained in their degraded state to show the damage that can be done by unwise use of resources and to illustrate the extent of recovery.

3. **Zone of Cooperation** - Managed to promote the development of cooperative activities between researchers, managers, and local populations to ensure a development that is harmonious with the region's natural and cultural environment. The zone of cooperation (or "transition area") would be outside of the core and buffer zones (i.e. the Virgin Islands National Park), undelineated, and expand as more cooperative research and demonstration activities are undertaken. For the Virgin Islands Biosphere Reserve, this area could encompass the marine resource use systems of St. Johnians wanting to participate in the program. Within this Zone of Cooperation, a traditional use sub-zone could be identified to study and protect cultural and resource use

practices which are in harmony with the environment.

Other approaches might also be used, such as those noted by the Man and the Biosphere Program Scientific Advisory Panel for Biosphere Reserves (UNESCO, 1986). The panel has noted the evolution of Biosphere Reserve implementation strategies under differing circumstances around the world. The original basic zoning scheme proposed by MAB of single "core" and "buffer" areas has in some regions been replaced by Biosphere Reserve "clusters" of geographically separated sites selected to cover the range of ecosystem types within a biogeographical unit or to add functions such as experimental research, traditional use, or rehabilitation of degraded ecosystems. In other regions of the world, efforts have been made to make Biosphere Reserves more fully functional by involving privately owned lands adjacent to the officially declared Reserves. Rather than simply being a precisely delimited area that "buffers" the core from outside disturbance, this "area of cooperation" encompasses a series of demonstration sites where projects aimed at achieving ecologically and socially sensitive development are undertaken with interested landowners or communities.

Selection and application of a zoning system in the VIBR should take several factors into consideration:

1. The development of a detailed zoning scheme should be undertaken as part of a general management plan for the Biosphere Reserve. A meaningful plan can only be undertaken when there is agreement among federal and territorial resource management agencies and resource users on the general framework for reserve management.

2. Cooperation among resource users and managers will be essential to the successful design and implementation of a zoning scheme for the Biosphere Reserve. Accordingly, no detailed zoning scheme should be drawn up without significant participation of resource users and the relevant government departments from the very beginning.

3. Resource users may be too busy in their daily affairs to give priority to the Biosphere Reserve Program, especially considering that it is new and untried. At present, the program lacks either official or unofficial recognition in the Virgin Islands (outside of a few individuals in VIRMC and the NPS). There is also concern that present management mechanisms do not function satisfactorily, and resource users may give priority to the improvement of these before any new programs are initiated.

4. The National Park has generally been conceived as the "core zone" of the Biosphere Reserve. In theory, this is to be composed of minimally disturbed ecosystems. This is the case of many of the terrestrial ecosystems, which, though thoroughly altered historically, are in general being allowed to evolve through natural successional processes. This is not the case, however, of coastal marine resources. Their use and apparent degradation within the Park/Reserve varies considerably, with the northwestern and northcentral bays most heavily used, and the southern bays some of the least disturbed in the U.S. Virgin Islands. To some degree, this is due to the calmer waters and

aesthetic features of the northern and central bays. Selection of a "core zone" should take these characteristics and patterns of use into account, with the more altered areas placed in the "buffer zone".

5. Easy access to all areas of the marine environment by boat makes it difficult to delineate and enforce meaningful management zones unless resident resource users are prepared to cooperate fully.

Given the factors listed above, at present only a general basis for delineating a system of marine management and use zones for development of a Biosphere Reserve in the Virgin Islands can be outlined. However, the need for carefully structured involvement of resource users and territorial and federal agencies in the application of zoning to specific areas of the Biosphere Reserve must be stressed. Otherwise, the development of strong cooperation among resource managers and users will be much more difficult to achieve. In any case, until a framework for the implementation of a Biosphere Reserve Program in the Virgin Islands is fully recognized by resource users and managers, there seems little to be gained from a theoretical zoning exercise. There are, however, several beginning points for zoning that have come to light through this project, and these are discussed in the following chapter on recommendations.

RECOMMENDATIONS

Based on the results and conclusions outlined above, the following points are recommended:

1. While the marine areas of the presently declared Biosphere Reserve are relatively representative of the inshore ecosystems of the Virgin Islands, many are apparently degraded and some small in area. The inclusion of other marine areas, such as some of those within the proposed parks and protected areas system of the British Virgin Islands, would improve the functional composition of the Biosphere Reserve. In addition, deeper offshore areas also need to be considered for addition to the Reserve.

2. Given the present lack of knowledge and recognition of the Biosphere Reserve in the community, it is urgent that agreement be reached with resource users and federal and territorial resource management agencies on a framework for pursuing the Program. Only then can a coherent management plan for the Reserve be developed, and through this, a detailed zoning scheme worked out.

3. Given the present status of the Biosphere Reserve, coincident with the National Park, it would seem appropriate to consider a zoning scheme which would include a "core zone" made up of the least altered, yet relatively representative, ecosystems within the Park/Reserve boundary; a "buffer zone" made up of the non-core areas within the Park/Reserve boundary; and an "area of cooperation" surrounding the officially declared Reserve, but which remains without delimitation and changes according to the cooperative demonstration projects being undertaken at any given time. The "core zone" and "buffer zone" would function as previously described, drawing on the concepts outlined by Batisse (1986). Only research consistent with National Park policy (in

general, nonmanipulative) would be permitted in the "buffer zone". The "zone of cooperation" would include the outreach aspects of the Biosphere Reserve Program, and encompass:

- project areas used to document traditional resource uses;
- research sites for developing practical means for restoring degraded ecosystems for multiple uses;
- demonstration sites where projects for ecologically and socially sensitive development are undertaken; and
- areas used as training sites, especially to highlight the Reserve's outreach activities.

4. While full participation of resource users and managers is essential in working out the details of the zoning scheme, it should be noted that some activities are incompatible with others, and will need to be given special attention. Fishermen, for example, point out that bait fishing can best be accomplished in shallow bays unimpeded by anchored boats, swimmers or snorkelers. A bank can be "raised" for line fishing only when no other boats are around. Scientists can get an indication of optimum harvest level for reef fish when some control areas are left totally unfished. Overfished areas can only be replenished by a decrease in fishing pressure or by in-migration of juveniles from adjacent areas. Swimmers and snorkelers can only practice their sport safely in areas without boat traffic.

5. Because relatively few practical means are available to manage heavily used marine areas, two specific, but controversial, management measures will probably be necessary ultimately - closure of a few, relatively small marine areas to all uses but non-manipulative scientific research, and mandatory use of mooring buoys from Cruz Bay in the west to Leinster Bay in the north. Such measures could only be implemented with the full understanding and support of the important user groups, a concerted public information campaign, and steady patrol by NPS personnel. Great care and diplomacy will be required to assure that each user group receives some important benefit out of a balanced management package. Each group must be assured that its concerns are taken into account and meaningful concessions made to their most important interests.

6. To keep development of the Reserve Program moving ahead until a widely recognized management structure can be developed, the question of reserve boundaries should be deferred until a climate of cooperation has been established between resource managers and users. Emphasis should be placed on the Reserve Program, rather than on the Reserve itself. Program activities should focus on resource use by St. John residents.

7. Until a management plan for the Reserve is in place, priority should be given to three major areas of activity:

a. A project to enlist the cooperation of federal and territorial agencies, community organizations, and individuals to seek solutions for the

difficult problems of congestion and pollution in the port of Cruz Bay.

b. A project to examine alternatives for development of Coral Bay. Special attention should be given to developing historical and cultural resources, maintaining valued elements of traditional lifestyles, and tailoring developments to the special needs of the different elements of the resident and visitor communities. Activities already proposed include:

- Study, development, and educational use of the Fortsberg ruins (proposed by professors of the University of the Virgin Islands)
- Development of the Carolina Estate and Bay Rum Factory as a community center, library, and 4-H Club center (proposed by DCCA and 4-H Program, Cooperative Extension Service, University of the Virgin Islands)
- Development of a marina facility taking account of yachting, diving, and fishing needs (proposed by Coral Bay Yacht Club); and
- Identification of critical areas requiring special management (Planning Office, DCCA)

c. A project to improve resource protection for the heavily used bays from Cruz Bay around the north coast to Leinster Bay.

d. A project with fishermen to study the problem of loss of baitfish stocks from St. John's waters and find feasible solutions.

Finally, it is recommended that the search for improved natural resource management be continued through the vehicle of the Biosphere Reserve. This is particularly important in the Virgin Islands where methods and techniques suitable to the small island environment are needed, where the human and financial resources of the U.S. are available to complement those of the Territory, and where many of the small island nations of the region could benefit from the experience gained here. Thus, the Biosphere Reserve could be instrumental in testing new approaches to resource management that will be beneficial not only to the Virgin Islands but to developing island nations worldwide. As an international program, the biosphere reserve is a tool particularly suited to the task.

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APPENDIX I - MARINE RESOURCE MANAGEMENT ISSUES
IDENTIFIED BY USERS INTERVIEWED BY KOESTER

The information in this appendix was gathered by Consultant Stephen Koester who was contracted to interview marine resource users of St. John. The text is modified from a report submitted by him to the Principal Investigator.

There are three major commercial marine resource user groups on St. John: fishermen, charter boat operators, and dive and snorkle tour operators. Local residents also engage in these same activities for recreation. Two marine resource interest groups were also identified: the Coral Bay Yacht Club and an ad hoc citizens' group concerned about a proposed 264-room hotel in Great Cruz Bay.

Due principally to time constraints, the consultant focused on those groups residing in St. John whose livelihoods depend on the marine environment. Commercial users of St. John's marine environment are by no means limited to the island, however. Fishermen from St. Thomas, the British Virgin Islands, and occasionally Puerto Rico make use of St. John's marine environment. Likewise, dive operators and charter boat operators from St. Thomas make daily use of St. John. For example, an issue of St. Thomas This Week (3/16/85) states,

A large charter boat fleet calls St. Thomas homeport. Several one-day charter boats sail to St. John or environs for a day of picnicking, swimming, and enjoying the salty breezes. Some carry only six passengers, others more. Many boats provide snorkeling gear and instruction; a few are equipped for scuba.

Eleven St. Thomas-based day-sail charters with advertisements in the same issue mentioned St. John in their ads. A St. John-based charter operator indicated that the heaviest use of St. John's marine environment is by St. Thomas-based operators. He estimated that a minimum of ten multi-passenger boats per day charter from St. Thomas to St. John during the tourist season.

Fishing is identified primarily with native St. John residents, although "down islanders" and "continentals" also fish. Fishing has an important place in both the culture and economy of St. John's long-term residents. It is undertaken as a commercial endeavor, for subsistence, and for pleasure. Most fishermen fish for all these reasons.

Two continentals own the most technically sophisticated enterprise. They use six mile longline to fish for swordfish in deep water. The most common fishing methods are handline fishing and setting fish traps. Only five or six men regularly handline for yellowtail snapper and other fish. These fishermen have established marketing arrangements with St. John restaurants. Four other pairs of fishermen set fish traps on a commercial scale, and they sell their catch to regular customers. A fluctuating number of other men, possibly forty, fish on a more irregular and less commercial basis using both handlines and fish traps. Only one sportfishing charter is based in St. John; other sportfishing charters which use the Biosphere Reserve are located in Red Hook, St.

Thomas (Koester, 1984).

Sailing and diving (including snorkeling) are more recent marine activities, and as commercial pursuits they are dominated by continentals. There are two basic types of sail charter operations: established, long-term businesses and the transient operators who sojourn in St. John to make money before sailing on.

Dive businesses interviewed included four in St. John and one in Red Hook, St. Thomas. Two of these dive operations were connected with businesses that did day- and term-sail charters as well. All but one dive operation included scuba instruction as well as dive and snorkel tours.

Local residents with an interest in the marine environment as recreational users were also interviewed by Koester. A few were members of the Cruz Bay Yacht Club, an organization described as being rather informal and geared toward social activities. Two very active interest groups contacted include the Coral Bay Yacht Club, a group of continentals residing in Coral Bay who want to build a marina, and a group, also primarily made up of continentals residing in St. John, recently organized to fight against the proposed 264-room Great Cruz Bay hotel. This group was organized around a theme called "The Futuring of St. John." Their purpose was to become actively involved in St. John's development and with issues they feel should be addressed. Some of those issues raised at a meeting included (besides the hotel), litter, parking, and traffic. Many of the members appear to be retired continentals concerned with maintaining the quality of life they came to St. John to enjoy.

The issues presented do not encompass all the concerns of these user groups; neither should the inclusion of any issue be taken as proof that it is of concern to all the users in any given category. Some issues were mentioned by only a few individuals, while others were mentioned more frequently. Only a small sample of the day-sail charter operators was surveyed, making it unlikely that the issues listed here represent a complete view of their concerns.

Additional issues of concern to fishermen

Turtles: Turtles are thriving around St. John, and some fishermen feel they should be allowed to capture them. "The fellows in Tortola are laughing at us. They're saying you release the turtles and we are eating them. That's a problem."

Whelks and conch: Fishermen are dissatisfied with Park restrictions on these shellfish. They feel the limit allowed is unrealistic. Gathering whelks and conch increases around carnival time when local residents have booths for celebrations.

Seining: Fishermen are split over the issue of seining. Some feel that the prohibition on seining is actually to their benefit. They argue that it is a way of keeping fishermen from other islands out of St. John's waters. "They should be damn glad the government came in and stopped seining. Otherwise,

they'd come in and wipe the small fishermen out." They also indicated that because of its effectiveness, the seine contributes to overfishing and the depletion of fish. "When you put a net around them, well then they ain't got a chance." Other fishermen suggested the problem is with seines that have such a small mesh that they catch fry, but that large mesh seines for kawang, hard-nose, bonito, and yellowtail should still be allowed.

Lack of cooperation among fishermen: Two common problems plaguing fishermen in St. John - pot theft and fishermen fishing other men's banks - are indicative of the lack of cooperation among fishermen. Pot theft is a commonly heard complaint of fishermen, and they agree that it is other fishermen who are responsible. One fisherman described pot (trap) theft as "the easiest thing for a man to do." Another fisherman explained he had trouble with people taking his traps and "they ain't no damn snorkelers, that's other fishermen." Fishing another man's bank is another complaint of local fishermen. Fishermen who take it upon themselves to raise a bank are territorial about it, while other fishermen argue that a man cannot control the sea.

Such a lack of cooperation among fishermen was seldom voiced by fishermen, but one admitted that it was "the biggest problem they have." He complained that fishermen will not share information and that some will even scare away the fry if they see another boat approaching to cast for bait. This same fisherman suggested that the reason I had not heard this from other fishermen is because it is not the kind of information they would tell an outsider. When asked why fishermen acted this way, he simply made a dollar sign and said that fishing has become very competitive. Finally, one fisherman's advice to me with regard to fishing was, "you don't let anybody know what you're doing or where you're going."

Outsiders fishing: This issue was raised by two young fishermen who resent continentals who have come to St. John and are making money fishing. They feel that these outsiders have access to information unavailable to local people and they use it to set up successful fishing operations. The two most successful fishermen in this category told me that they make a point of not catching the same fish as locals, but rather fish deep sea for swordfish. One of the young fishermen who complained about these continental fishermen now intends to follow their example and is currently rigging a boat to fish swordfish.

A local resident, who is also a National Park employee, noted that the intensive fishing techniques now used by St. John fishermen were introduced by outsiders. Local people never thought of buying a large winch to raise hundreds of pots. He believes that continentals first introduced scuba tanks for diving for conch and lobster about ten years ago.

Outside control of U.S. Virgin Islands National Park environment: Some fishermen resent outside control of the Park and what they feel is a lack of sharing of information collected from research. One fisherman stated his frustration by saying, "The people who are running the Park don't know anything about the environment. They know it by reading books. I know it by seeing it every day of my life."

Other fishermen felt that research done by scientists was of little use unless it was shared with them.

Regulations: During interviews, it became obvious that fishermen were divided on the question of regulations. Although there is resentment toward "outsiders" making regulations and enforcing them, this seems to be tempered by the realization that some of these regulations are beneficial and in fact protect their interests. Some fishermen felt that these regulations act to keep bigger, more intensive fishing operations out of St. John. Fishermen also recognized that the environment has been depleted and that fishing may be one factor contributing to its overuse. One fisherman suggested restrictive regulations are necessary, "otherwise, we wouldn't have what we have now."

At the same time, fishermen admitted occasionally breaking regulations. One said he had taken a turtle, and others asserted that the regulations on whelks and conch were unreasonable.

Additional issues: sail charterers

Moorings: Charter boat operators suggested that the Park should install moorings in areas where anchor damage is apparent and use is heavy. Many areas where anchor damage is most serious are outside the Park, but they feel these areas could also be protected with moorings.

Charter boat operators were very concerned about the Virgin Islands Department of Conservation and Cultural Affairs' new mooring law. They are worried about how it will affect their businesses. As it stands, when the mooring bill takes effect no permanent moorings will be allowed in Cruz Bay. Operators also felt that if a mooring law is instituted, increased services should follow. Operators in Cruz Bay want an easily accessible place to dispose of trash and obtain fresh water.

Bareboats: Conflicts between different user groups such as fishermen and sailors increase with inexperienced users. One charter operator thought that a problem like yachts or power boats cutting across the transom of a fisherman chumming (float fishing) or even trolling was due primarily to ignorance.

A charter boat operator believed that the rapid increase in bareboating is the single biggest impact now occurring in the Virgin Islands marine environment. He compared them to Winnebagos, saying, "they just turn 'em loose and they go anywhere."

National Park Service: In general, charter boat operators complained about the prevailing law enforcement focus of the Park Service. One operator mentioned that he had been told five times in one day by rangers about the 14-day limit on anchoring in the Park. He also complained about the Park not allowing him to have his charter boat sign on his yacht when it is in Park waters. He felt that since the Park had given another operator an exclusive Park concession, he should at least be permitted to advertise. Another

operator said that his rapport with the Park had deteriorated in the last few years. He complained about continued harassment by one ranger in particular and saw no reason for rangers to carry guns. He argued that the Park has changed from a policy emphasizing management to one that focuses on enforcement. "They pick on unimportant things rather than what's important. They can't see the forest for the trees."

Additional issues: dive operators

Bareboats: A dive operator suggested that the rapid growth of this industry has had a major impact on the use of St. John's marine environment. He said it is common during the tourist season to have thirty bareboats anchored in Francis and Maho Bays. He felt that the popularity of bareboat charters not only increased the numbers of people using the environment but also increased the number of inexperienced sailors who could have access to it.

Spearfishing: All dive operators interviewed prohibit their clients from spearfishing or from collecting any marine species. Two of them complained about a dive operator who does allow the use of spearguns on his tours. They see this as a threat to a limited number of dive sites that they all must share. Many of the fish are so tame from constant feeding from divers that they are easy targets for spearguns. Two operators said they will occasionally spearfish for their own meal. One of them felt that the Park Service should put more energy into controlling fish traps instead of spending so much time enforcing speargun regulations.

Moorings: Dive operators suggested having moorings at popular dive sites as a way to decrease anchor damage to the reef and as a safety precaution. Two operators described incidents when anchors were dropped over them.

Resource depletion: For dive operators whose business depends on the sea life around reefs, this is a major concern. They were particularly worried about anchor damage to coral and the high quantity of dying coral they observed. One diver said that Eagle Shoal has only 10% of the living coral it had five years ago. They are also alarmed by the decrease in fish and seem to blame fish traps and spearfishing. One diver said he judges the human impact on a reef by the number of Tiger and Nassau Groupers he sees. He said that a big Nassau Grouper around St. John is now 4 lbs.; when he first came (eight years ago) he regularly saw Nassau Groupers 8 to 12 lbs. Now he says, "I'm lucky if I see one Grouper per dive." Another diver who had been in St. John for several years and specialized in catching Spiny Lobster lamented the fact that lobsters have become increasingly scarce. He thinks this is due as much to the degradation of their habitats as it is to overfishing.

Two operators mentioned recent changes in reefs. One described a gray algae covering rocks and reefs in the areas where he dives. He suggested that it is possibly due to the absence of sea urchins. Another diver described an amber colored stringy substance floating on the bottom. He said he cannot identify it but believes it to be some form of pollution.

Conflicts with other users: Dive operators all mentioned an unnamed dive operator who they claimed is destructive of the environment. They accused him of allowing spearfishing on tours, anchoring over coral, and taking black coral from Haulover Bay. The only other problem they have among themselves is the logistics of sharing a limited number of dive sites. One operator described how on five recent dive trips to the wreck of the Rhone on Salt Island in the British Virgin Islands he was forced to take his tour somewhere else because five other dive tours were already there. The popularity of this and other dive sites has made them dangerous areas to dive. He said he has been diving the Rhone when anchors have been dropped in the vicinity of divers and when power boats have cruised directly over divers.

Both fishermen and divers acknowledged having a conflict between their respective uses of the environment. A few divers admitted opening unmarked fish traps believing that these traps were illegal or ghost traps.

A dive operator had an argument with a fisherman casting for bait at Thatch Island when he came too close to the submerged divers. At Peter Island this same diver has had fishermen "become frantic" when he has shown up with a dive tour because they are afraid the divers will disperse the fish.

Issues and conflicts between user groups

A comparison of issues and users indicates little conflict between dive operators and day-sail charterers. Although most day-sails include snorkeling as part of the package, it does not appear that this causes any direct conflict with dive charterers. It appears that these two user groups co-exist with only a minimum number of problems. It is equally clear that they share a number of concerns. Both groups have been adversely affected by BVI Customs, both agree that anchor damage is a serious threat to reefs, and their opinions about marine traffic, the mini-cruise ships, the enforcement attitude of the NPS, and the issue of overuse are all very similar. They also seem to have similar problems with fishermen, whom they hold at least partially responsible for the depletion in fish. Both groups feel that unmarked and lost fish traps are a major problem. Fishermen likewise feel that both of these user groups interfere with fishing. Divers open traps and sometimes hamper line fishing. Charter operators and yachts in general hinder fishermen's access to bait by cluttering up bays with anchor lines.

This conflict between these two relatively recent, commercially oriented, tourist-based activities and fishermen has a cultural basis as well as an economic one. As previously mentioned, fishermen are predominately native St. Johnians while both dive operators and sail charter businesses are owned by continentals and serve a predominately continental clientele. To what degree these cultural differences foster conflicts in resource use is unknown. The important point is that if a major objective of the Biosphere Reserve Program is to elicit community-derived guidelines for management and to resolve conflicts between different resource users, it will have to consider the plural nature of this island community.

That these cultural distinctions present a major hurdle for the Biosphere

Reserve Program was made clear in conversations with different resource users. A young fisherman refused to speak about fishing and simply said, "to tell you the truth, I don't talk to pirates. If you want to know about fishing why don't you go talk to Travers [a continental]."

A day charter operator repeatedly complained about discrimination in the Virgin Islands government toward continentals. He described incidents in which local residents discriminated against him, and he was very upset about the new DCCA mooring law which will exempt traditional West Indian fishing boats.

While cultural distinctions play a major part in the social division of St. John, the characteristics also act to set groups apart. The majority of residents at a meeting organized to oppose the construction of a hotel in Great Cruz Bay were retired continentals who had homes on the hillsides above Cruz Bay. For this group the construction of a 264-room hotel was seen as a direct threat to their quality of life. Perhaps the absence of other community members from this meeting was due in part to their more ambiguous feelings about the hotel. For members of the community who depend upon tourism for their livelihood, the hotel was probably seen as a means for improving their quality of life.

The rapid growth of Coral Bay demonstrates the need for developing better understanding between different marine resource user groups and the separate subcultures they represent. The Biosphere Reserve Program would be a benefit to the entire St. John community if it could somehow act to facilitate such cooperation. The Coral Bay Marina Project involves the entire Coral Bay community and all three of the major marine resource user groups. Although Coral Bay is outside of the National Park boundary, the impact of its growth on the Virgin Islands National Park will be extensive. Currently, a small group of continentals living in Coral Bay is actively trying to build a marina. Coral Bay is the largest, most protected harbor in St. John, but it is limited by the lack of services offered in the community; there is no gas station, only a small grocery, no dock, and no marina. In the last few years, yacht visits to Coral Bay have increased dramatically. Local residents stated that up until five years ago there were never more than ten yachts in the bay. Now it is common to count thirty or more.

Some yachts have put down moorings, and a new resident community living on yachts has developed. A few members of this community have established yacht-related businesses (a bar, restaurant, dive shop, marine parts store, and boutique). Recently, these same residents organized the Coral Bay Yacht Club to coordinate their efforts to bring a marina to the bay. They have already drawn up plans, discussed obtaining the lease for the property they want from its current holders, and developed a mooring plan. They admit to having little success in getting the long-term residents involved in their project however. They recognize that this is a serious problem and have in fact included what they think are the interests of local fishermen in their plans. They have reserved space for fishing boats at the dock as well as a place for fishermen to clean and sell fish. These plans are made without the input of local fishermen, however.

Native Coral Bay residents are aware of the proposed project, and those interviewed seem either to be resigned to it or against it. None of them have taken an active stance fighting the plan or trying to get involved with it. The general feeling seems to be that it will happen and if not by Coral Bay people themselves, by some large yacht charter company. It seems that in the interests of Coral Bay, its residents, and all of St. John, some kind of community organization should begin discussing Coral Bay's future and planning for its inevitable development so that when it does occur, local people can protect their interests. Perhaps a biosphere reserve program could offer encouragement and technical support for such community efforts.

Overuse

All users acknowledged that overuse was a serious problem in the VIBR. Most fishermen and every sail charter and dive operator mentioned that the quality of the marine environment and the quantity of its resources had both decreased in the time they had been observing it. Although all users seemed to prefer blaming someone else, the mini-cruise ships, the fishermen, swimmers with lotions on, ghost fish traps, etc., it seemed that they were aware that, at least on some level, everyone who used the environment was leading to its degradation, at least to some degree.

Many users have adjusted to the VIBR's overuse by simply not using it or lessening their use of it. This is particularly true for dive operators who prefer cays close by St. John. Even day-sail charterers based in St. John stay away from the National Park, preferring instead to take their charters to the bays outside the Park on the east end. Many of the fishermen regularly seek bait fish on neighboring islands, and several of those who use handlines go all the way out to the drop-off on the south shore and fish banks on its edge. St. John-based marine users have adapted to overuse by extending their use to more distant areas.

Issues between resource users and resource managers

A recurring theme in discussions with marine resource users in all three categories was the enforcement-oriented approach of the National Park Service. Most surprising is that charges of harassment were voiced not only by fishermen but by long-established day-sail businesses as well. One charter operator in particular agreed with fishermen that it was in fact harassment when a particular ranger would repeatedly stop him at sea for a variety of reasons. Because of its recurrence in conversations with several users, this issue merits some close attention. Otherwise, the cooperation required for the solution of management problems cannot be developed.

Although specific regulations were denounced by several fishermen, some local fishermen defended regulations on fishing. Those who argued for regulations gave two reasons: 1) with regulations St. John's marine environment became less attractive to fishermen from other islands, thus saving it for local use; 2) fishermen realize that marine resources have decreased and that therefore they must be given some protection. Several fishermen suggested making regulations more flexible, or instituting a grandfather clause that

would give them an exemption from restrictive regulations but maintain them for others. Several fishermen felt that since turtles were thriving, they should be permitted to have a limited season to take them. Another fisherman suggested raising the limit on conch and whelks to coincide with carnival in St. Thomas and St. John, since many people here traditionally have booths in which they sell conch.

Other resource users were not so much critical of the NPS regulations as they were critical of NPS enforcement. Day-sail charter operators saved their complaints on regulations for the Virgin Islands government. They resented what could be considered overregulation for two reasons: 1) they received no services in return for registering dinghies, the new mooring law, etc.; 2) they felt the regulations discriminated against the boating community and demonstrated a lack of recognition on the part of the Virgin Islands government regarding the dollars the charter boat industry brought to the Virgin Islands. Fishermen had nothing good to say about the enforcement division of the DCCA. They regarded it as ineffective because they rarely see DCCA enforcement officers. This limited DCCA presence seems to be a chief reason some St. John fishermen have not bothered to color code their traps, even though this regulation is designed to cut down on trap thefts.

Conclusion

One of the most difficult aspects of interviewing the marine resource users of St. John was explaining the Biosphere Reserve Program and what it could possibly offer to different marine resource user groups. This was made especially difficult because of the lack of any well-defined biosphere reserve policy or management framework. This prevailing ambiguity about just what a Biosphere Reserve is and what it can offer local people needs to be clarified before any more work with local groups is attempted. The residents of St. John have a collective experience that encourages them to be suspicious toward resource management programs. Unless the Biosphere Reserve Program is presented to them as a coherent policy with a sincere purpose, it will only serve to further alienate the community.

By raising people's consciousness about the "biosphere", we in fact start a grass roots biosphere reserve program to develop. For example, a meeting held with fishermen provided them the opportunity to voice their concerns directly to the Superintendent of the National Park. If none of these issues are addressed, it seems likely that fishermen will lose interest in the Biosphere Reserve Program. Once we begin to ask people what they are concerned about, we should be in a position to help solve their problems.

Summary of fishermen's meeting, Tuesday April 6, 1985, Hilltop Restaurant,
St. John

In attendance:

George January	Allen Putney
Jason Dalmida	Greg Nichols
Alvin Newton	Larry McClain
Gilbert Sprauve	Rich Wood
Paul Thomas	Ira Martin
Noel Pacht	Victor Sewer
Randy Walters	Julius Sprauve
Caroline Rogers	Fred Smith
Steve Koester	Claudia Nissley

Meeting was opened at 6:30 p.m. with introductory remarks about the Biosphere Reserve Program by Steve Koester, an anthropologist working on the VIRMC project for Allen Putney, Principal Investigator of ECNAMP. Mr. Putney made a few brief comments on the Biosphere Reserve Program and the floor was opened for general discussion.

In general, the discussion centered around fishermen's concerns, and questions were referred to Noel Pacht, Superintendent of the Virgin Islands National Park, and to Randy Walters, BVI Fisheries Officer.

The issues and concerns as well as the suggestions made for alleviating them are listed below. No attempt was made to prioritize issues; they are not listed in any order. If any issues or suggestions were excluded from this summary, be advised that it was not intentional.

Summary of issues and concerns

Issues	Proposed Solutions and/or Alternatives
1. Turtles. Conflict due to differences in US and BVI law: fishermen now subject to some "imaginary boundary" between islands.	None
2. Missing fish traps.	None
3. Yachts cutting trap lines.	(a) Pop-ups (expensive) (b) Notify yacht chartering companies to impress on clients the need to watch out for trap buoys.
4. Not being able to catch running fish or bait such as ballyhoo, fry, or sprat in NPS waters,	Bait fish can be caught with a 20-foot boat seine net (except at Trunk Bay).

Issues

Proposed Solutions and/or Alternatives

- although this is a long-standing, traditional cultural practice for native St. John fishermen.
5. 20-foot seine net regulation unrealistic; difficult to catch anything with only 20 feet. To change regulation would require a change in the law.
 6. BVI fishing boats come to St. John without clearing to sell fish, while St. John fishermen must obtain a permit to fish in BVI waters. While the BVI requires permits to fish, none are being issued. Reciprocal Fishing Agreement ambiguous, not being enforced and may even be rescinded.
 7. Lack of protective enforcement for local fishermen by DCCA. None
 8. Tendency of fishermen to regard all regulations as coming from NPS. Improved communication and explanation of regulations. Need to know what agency responsible for different regulations.
 9. Harassment of fishermen while fishing by VINP rangers. Report specific incidents to Park Superintendent. See Issue #18.
 10. Harassment by security people at Caneel Bay. Report specific incidents to Park Superintendent. See Issue #18.
 11. Perception by local residents that many places in VINP are closed off to people who want to fish from rocks with rod and reel (trail guide refers to "hikers"). Clarification of policy.
 12. Belief that research programs are designed to increase VINP funding but do not help local residents. Develop a policy advocating communication between community and NPS. Explain purpose of studies and make their results known. Design research that seeks answers to locally perceived issues.
 13. Large commercial tuna boats operating in VINP and surrounding area. Increased enforcement effort focusing on this problem.
 14. Enormous escalation in use of VINP by visitors (snorkeling, Protection for resident fishermen, their techniques, and the resources

Issues

Proposed Solutions and/or Alternatives

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| diving, swimming, boating).
Overuse possibly responsible
for decline in bait fish. | they depend on from these activities. |
| 15. Traditional uses of resources
are being restricted: gathering
of crabs now restricted and raw
materials for fish traps cannot
be obtained from within the Park. | Manageable harvest areas for local
residents only. See Issue #16. |
| 16. VINP regulations should empha-
size regulation of visitor acti-
vity and not traditional activi-
ties of local residents. | (a) A "grandfather" clause excluding
native St. John fishermen using
traditional methods from restric-
tive fishing regulations.
(b) In the U.S. Great Lakes Region,
there are some areas set aside for
local resident use only. |
| 17. A muddy run-off into Lameshur Bay
is causing siltation and affect-
ing the availability of fry in
the bay | A research effort with recommendations.
The problem is also noticeable at
Hawksnest Bay due to run-off from the
new clinic construction and at Reef Bay
from new house construction. |
| 18. Fishermen dissatisfied with what
they feel is an overemphasis on
enforcement by Park rangers
toward them. | Fishermen want to minimize contact with
Park employees while they are fishing.
This is particularly important when
line fishing. Fishermen suggested Park
staff should get to know their boats
better so that they can recognize them.
Also suggested stickers for their boats
identifying them as St. John fishermen. |