

User perceptions on coastal resource state and management options in Curaçao

Adolphe O. Debrot and Ivan Nagelkerken

CARMABI Foundation, Piscaderabaai z/n, P.O. Box 2090, Curaçao, Netherlands Antilles. Phone: (5999) 4624242; fax: (5999) 4627680; carmabi@cura.net

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Abstract: Public environmental awareness and support for management measures are key determinants of the scope for successful implementation of natural resource management. To assess user perceptions and opinions on resource state and potential management options for the coastal zone of Curaçao, we queried 250 coastal resource users from around the island (sport divers, part-time artisanal fishermen and recreational boaters) using questionnaires. There is wide awareness of a long-term decline in coastal resource condition as measured by various indicators. Even among fishermen there was wide awareness of anthropogenic contributors to the decline, broad agreement of management measures required and a general willingness to contribute to management by means of annual license fees. Some of the more salient findings include the endorsement by fishermen of the current ban on spearfishing (81%), the regulation of the beach seine fishery for scad (77%), the introduction of fish reserves (72%), special protection for sea turtles (90%), conch (82%), and lobsters (72%), and notable support for gradual elimination of trap fisheries (45%). Also, both divers (65%) and boaters (92%) expressed the importance to them of an attractive coastline, with both groups expressing preference for natural (un-built) coastline (>74%) above other categories. Management based on the concept "user pays", as already implemented in the Netherlands Antilles on Saba and Bonaire, is well supported by the resource user public. A review of other main constraints such as finances and institutional capacity, shows that conditions are quite favorable for implementation of new legislation. Modern coral reef management is urgently needed in Curaçao to safeguard a key natural resource and concerted action is called for on the part of government agencies, legislators and elected officials.

Key words: Caribbean, coral reef, fisheries, user perceptions, coastal resources, management.

In natural systems direct manipulation of biological production factors is generally not possible and resource management is often more about managing how people interact with resources than about managing the resources themselves. Also, aside from maintaining a healthy ecosystem, a salutary recreational experience for resource users is typically a key management objective. For these reasons, surveys and opinion polls among

users have proven to be particularly useful management tools. They can help decision makers and managers identify management needs, choose between management options, help pinpoint strategies for successful introduction of rules and regulations (*e.g.* Rudzitis and Johansen 1991, Jennings 1992, Watson *et al.* 1992, Chavez 1993, Johnson *et al.* 1993, McIvor and Conover 1994, Hubert and Gipson 1996), and may even provide valu-

able information on the natural history of the resource (Johannes 1981). They further represent an important conduit for public participation, which today is considered essential to sustainable management success (Anonymous 1993a, Johnson *et al.* 1993, Durbin and Ralambo 1994, Geoghegan and Barzetti 1994, Mkanda and Munthali 1994, Pinkerton 1994, Renard 1994, Shindler and Neburka 1997). With exception of two small studies (Kruijf, de and Arends 1975, Freitas, de 1998) practically nothing is known about public attitudes towards natural resources in Curaçao.

Curaçao lies in the southern Caribbean, about 60 km off the north coast of Venezuela and is the largest of the five islands of the Netherlands Antilles. Surface area is about 444 km², and the island is rimmed by fringing coral reefs. Population size is about 145 000 inhabitants and the regionally high per capita GNP (Anonymous 1996) is principally supported by petroleum refinery, financial services, tourism, trade, and ship repair and maintenance. The literacy rate exceeds 95% (Anonymous 1992b) and the principal languages are Papiamentu, Dutch and English.

The reefs of Curaçao are of major economic value to the inhabitants of the island and form the basis for countless jobs in sectors such as tourism, fishing, boat service and maintenance, retail and diving. Dive tourism amounted to US\$ 18 million in foreign exchange earnings in 1997 (Anonymous 1998a) and has high growth potential. Of the total annual fishery yield of upwards of US\$ 3.3 million a year, the Agricultural Service of Curaçao (Anonymous 1992a) estimates that 10% is directly or indirectly derived from reef stocks. However, the contribution of reef fish stocks to total catches is likely to be underestimated as most reef fish catches never pass through the main fish landing sites. In addition, the reefs are of cultural, educational, ecological, scientific, aesthetic and broad recreational value and are enjoyed directly and/or indirectly by thousands of island visitors and residents each week. Preliminary

instantaneous counts during June-August 1995 indicate a minimum of 8 700 beach visits island-wide per week (Hof, van't *et al.* 1995). Coral reefs constitute the island's most important renewable natural biological resource, for which the combined value of non-extractive resource use (tourism and recreation) greatly exceeds the value of combined catches. Yet nutrient enrichment, over-fishing and habitat destruction are all a serious threat to both forms of use. Rapid ecological degradation of the reefs of the island has been documented (Bak and Nieuwland 1995, Debrot *et al.* 1998, Debrot and Sybesma *in press*) and means that effective management is urgently required to preserve and enhance principal user values.

Public environmental awareness and support for management measures are key constraints to the scope for successful implementation of management. Prior to developing a reef management plan as commissioned by the Curaçao Tourism Development Bureau (CTDB) (Hof, van't *et al.* 1995), we queried 250 coastal resource users from around the island of Curaçao to assess their views on resource state and potential management options.

MATERIALS AND METHODS

Mid-1995 surveys were conducted among three primary coastal user groups, namely fishermen, scuba divers, and boaters. The surveys were based on questionnaires, individually developed for each user group in English and/or the native Papiamentu. The questionnaires borrowed significantly from those used by Scura and van't Hof (1993) in Bonaire. Questions were almost all formulated as multiple choice questions to facilitate both interviews and analysis. The Antillean Guilder (1.8 ANG = 1 US\$) is the local currency of choice but all prices were converted to US\$ for presentation.

The fishermen were the most labor-intensive group to locate. It was also considered likely that (in contrast to divers and boaters)

they would generally not return questionnaires, and all fishermen were personally interviewed on the basis of the questionnaire in Papiamento by locals familiar with the fishery. At the outset it was made clear to all that the survey was anonymous. No names were recorded and the interviewer generally did not know the interviewee. Fishermen were interviewed at 12 different locations on the island, for a total sample size of 100. The largest number of interviews obtained from a single landing place or village was 21.

Diver questionnaires were distributed through the 15 commercial dive operators on the island and the Diving Club Curaçao (DCC). Questionnaires were collected personally from these organizations until a sample size of 100 was attained. The largest number of completed questionnaires obtained from a single organization was 15, indicating a good spread amongst organizations.

Questionnaires were personally handed out to boaters of the Spaanse Water bay who were asked to return these in stamped, self-addressed envelopes. The Spaanse Water bay, with about 1 000 vessels is the principal recreational boating area of the island. After a period of two weeks a reminder was distributed to the 78 boaters who could be relocated. This yielded a 40% total response rate for boaters. An additional ten personal interviews were conducted among boaters to reach the pre-selected minimum sample size of 50.

Results from the questionnaires basically came down to proportions of respondents choosing or rejecting certain propositions, and all results were expressed as percentages. For the principal findings, these percentages are followed by approximate 95% confidence intervals calculated by binomial approximation (Walpole and Myers 1978), after appropriately pooling the different response categories. In this, nonresponse was not discarded but was pooled in a conservative fashion (generally to the fraction rejecting the proposition) so as not to produce confidence intervals that might be narrower than justified under assumption of the binomial model.

Confidence intervals for proportions calculated by binomial approximation are robust in that they can also be used to approximate confidence intervals for the hypergeometric distribution (Walpole and Myers 1978).

RESULTS

Fishermen: Contrary to the view that fishermen are often very difficult to approach, we found them surprisingly willing to cooperate with the study. Less than five refused cooperation or could otherwise not make time available for the interview. Seventy-six percent stated to have been fishing more than 15 years and 82% went fishing one or more times a week (N = 100). Sixty-two percent used a boat 90% or more of the times they went fishing. As a rule, the boats used for fishing are locally built vessels with fibreglass over wooden hulls and small diesel engines or outboard motors. Ninety-two percent of the fishermen interviewed were older than 30 years with approximately equal representation across the age groups 31-40, 41-50, 51-60 and >60 yrs. The majority of the fishermen (56%) had full-time employment, while 17% had only part-time employment and 24% were retirees (Fig. 1). Only 17% depended on fishing as their principal source of income.

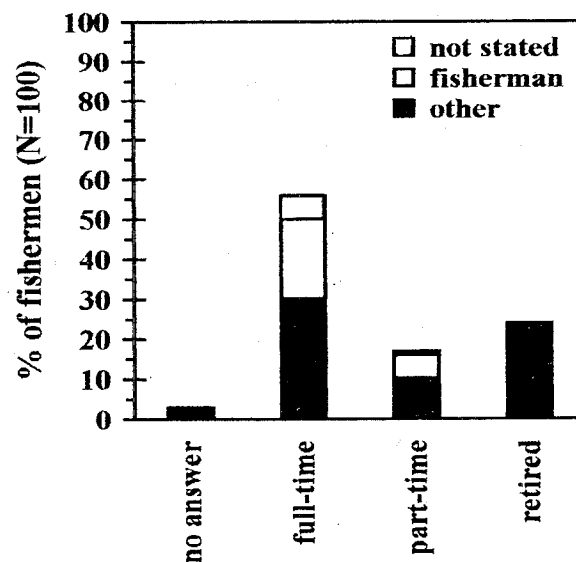


Fig. 1. "What is your present employment status?"

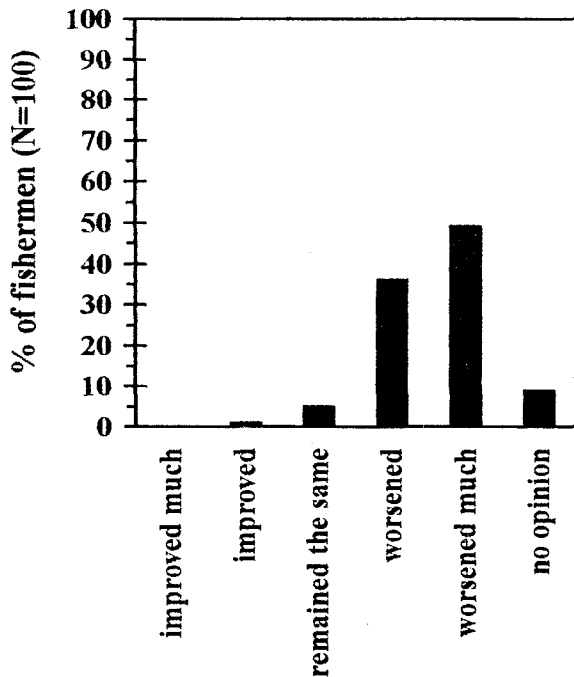


Fig. 2. "Would you say that during the last ten years shallow-water and bottom fishing has....?"

The respondents were almost unanimous in their opinion that near-shore reef-associated catches have declined over the past ten years. A statistically significant majority ($85 \pm 7\%$) indicated fishing had become either worse or much worse (Fig. 2). The five most frequently mentioned factors that were believed to have contributed to this decline were: small mesh-size nets ($72 \pm 10\%$),

spearfishing ($72 \pm 10\%$), pollution ($67 \pm 10\%$), excessive fishing effort ($48 \pm 11\%$), and fish traps ($34 \pm 10\%$) ($N = 85$, Fig. 3).

The comments given by respondents indicate that most fishermen have all but written-off demersal/reef fishing along the southwest coast and feel that a total collapse has taken place in the last decade. As a result, some fished less frequently than before, while others fished more to compensate for the lower catch rates. Fishermen generally found that good fishing was still possible on the less accessible wave-exposed northeast coast but many indicated that even there, fish abundance has been falling.

When asked about management interventions, $90 \pm 6\%$ of the respondents ($N = 100$) felt there was a need to manage the fishery (Fig. 4a) and $79 \pm 8\%$ were willing to pay a US\$ 3-5/yr fishing license fee to help achieve basic management objectives (Fig. 4b).

Fishermen were also quite outspoken about the type of measures that are needed to improve the fishery. A statistically significant majority expressed support for the current ban on spearfishing ($81 \pm 8\%$), limiting small mesh-size *redas* (seine nets) ($77 \pm 8\%$), and the introduction of fish reserves ($72 \pm 9\%$) (Fig. 5). While $60 \pm 10\%$ favored measures to

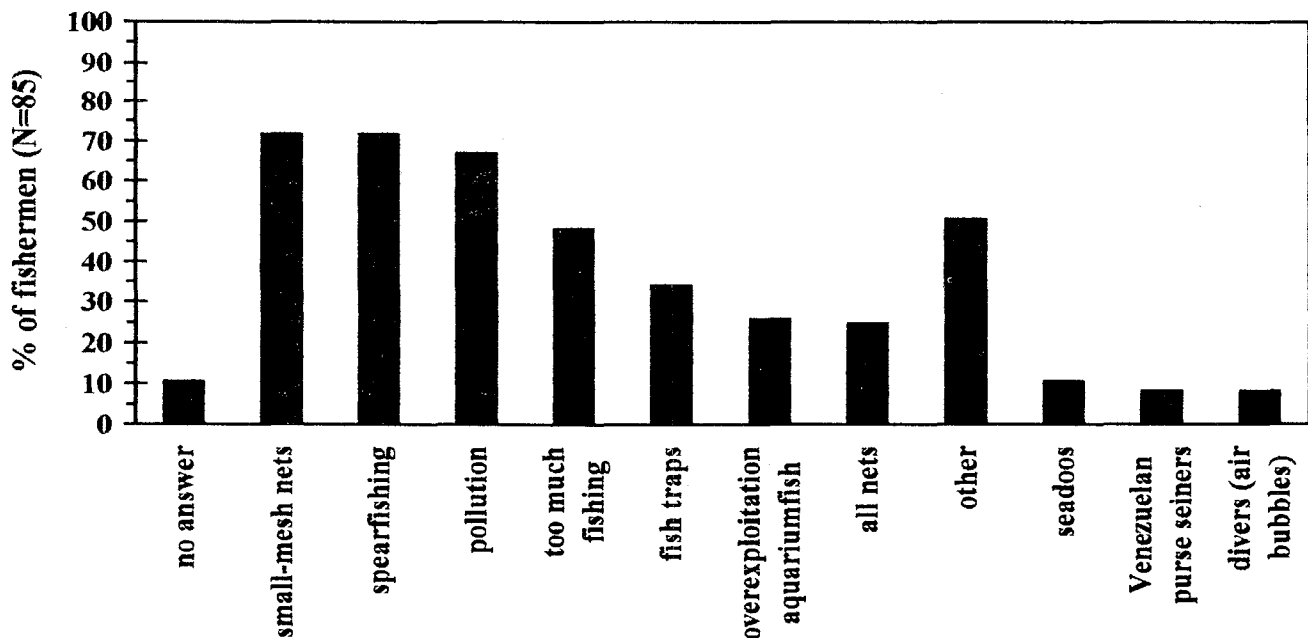


Fig. 3. "If you find that the reef and shallow-water fisheries have worsened during the last ten years, which of the following seven (or other) factors do you think are responsible for this?"

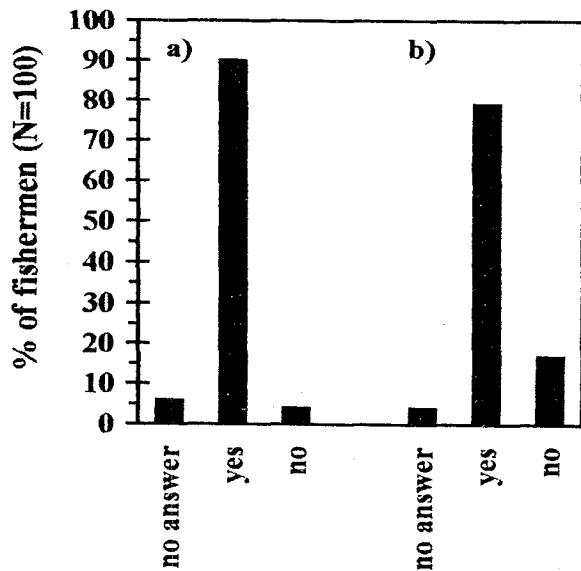


Fig. 4. a) "Do you think the fisheries should be managed in Curaçao? b) Would you be willing to contribute a small amount (say US\$ 3-5) annually in the form of a fishing license?"

reduce pollution, limiting fish traps was less favored as a management measure ($45 \pm 10\%$). Very few fishermen actually use traps, but fish traps remain important for a very few elderly and disabled fishermen. Although fishermen were also generally aware of the

deleterious effects of unregulated trap fisheries, most felt that any measures to regulate or eliminate trap fishing should respect the rights of the few who still depended on them.

Most fishermen also indicated the need to regulate the *reda* fishery (largely directed at schools of bigeye scad, *Selar crumenophthalmus*), not only in terms of mesh size but also in terms of the number of nets and the location where each net can be deployed. Traditionally, the fishermen of each of a limited number of beaches had their own net and had exclusive "rights" to harvest there. This allowed them to delay harvest to allow small schools to grow larger and to refrain from harvesting schools with too many undersized scad. Self regulation also had additional benefits, as the schools of bait fish at beaches served to attract larger game fish, to the benefit of all fishermen. Today such self regulation does not function. Fishermen are forced to rapidly harvest even small schools of under-sized fish from "their" area before opportunistic fishermen from other parts of the island move in and do so.

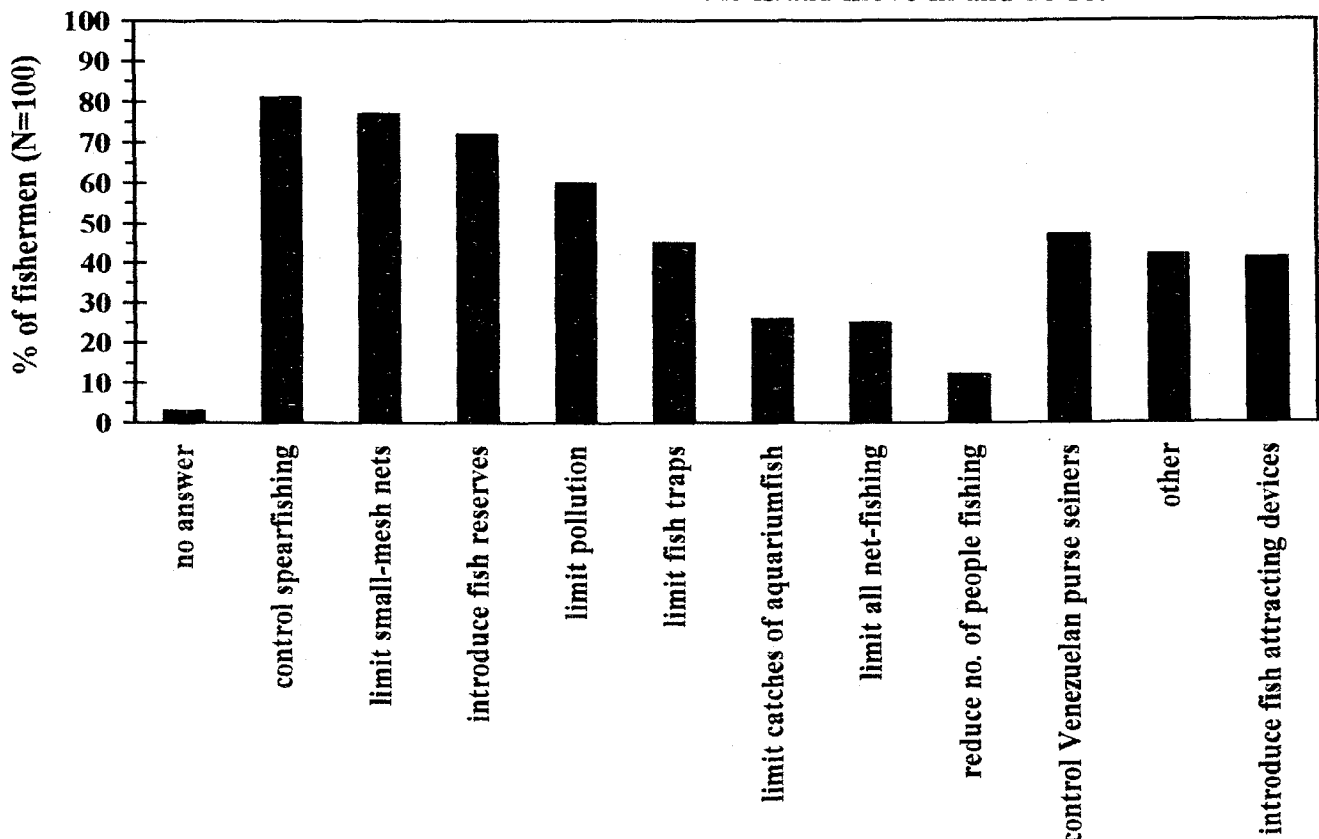


Fig. 5. "Which of the following eight (or other) measures do you think are necessary to improve the fisheries?"

Forty-seven percent ($\pm 10\%$) would like to see a ban on the Venezuelan tuna purse seiners while $41 \pm 10\%$ would also like to see additional fish attracting devices (FADs) installed (Fig. 5). At the time of this survey, the Agricultural Service had one FAD deployed in deep waters about 1 km south of Caracasbaai. The FAD basically consists of a buoy which attracts pelagic game fish.

There was considerable agreement about protection of species. A significant majority of the respondents felt that turtles ($90 \pm 6\%$), conch ($82 \pm 8\%$) and spiny lobster ($72 \pm 9\%$), which are all only sporadically seen or taken, could be fully protected. Thirty-one percent ($\pm 9\%$) endorsed introduction of size limits for capture to ensure adequate maturation of key target species (groupers and snappers). Size limits should certainly be useful as live release of hook-and-line caught fish from depths of up to 62 m has been found to be effective (Wilson and Burns 1996).

Divers: Fifty-four percent of the respondents ($N = 100$) resided in Curaçao and of these 52% were or had been working in the dive industry. Forty-eight percent of resident divers ($N = 54$) had been diving less than five years and 31% between five and ten years. Of the non-resident divers ($N = 46$), 35% had visited the island more than once before. The nationality of non-resident divers was largely Dutch (54%), U.S. (20%) and German (17%). The largest group of divers (36%) was in the 21-30 year age group, while 50% were in the combined 31-40 and 41-50 age groups. Sixty-seven percent ($\pm 9\%$) of all divers had logged more than 100 dives.

Eighty (± 8) percent of divers ($N = 100$) rated the variety and abundance of corals as either good or very good, whereas only $48 \pm 10\%$ rated the variety, abundance and size of the fish as either good or very good. However, of those with ≥ 5 years of experience in Curaçao ($N = 57$), $71 \pm 12\%$ felt that the variety and abundance of corals had either decreased or decreased much over the last five years while $64 \pm 13\%$ thought fish life

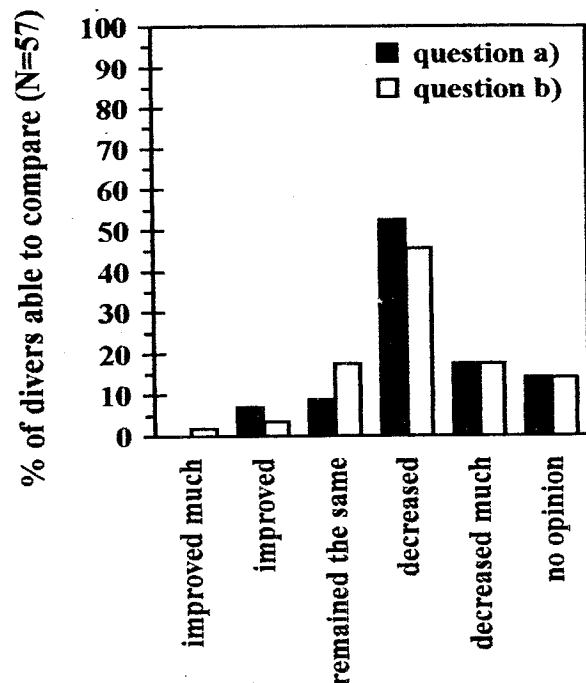


Fig. 6. a) "Based on your experience, if you compare the current variety and abundance of coral in Curaçao with that of five or more years ago would you say that they have:....?" b) "Based on your experience, if you compare the current reef fish life in Curaçao with that of five or more years ago would you say that it has:....?"

had either decreased or decreased much (Fig. 6). Among those who had experience elsewhere ($N = 72$), only few ($26 \pm 10\%$) rated the variety and abundance of corals as either better or much better than other destinations, while even fewer did so when considering the variety and abundance of fish life ($13 \pm 8\%$). A significant majority ($64 \pm 11\%$) found average fish sizes seen in Curaçao to be either smaller or much smaller than at other destinations. A statistically significant majority of divers ($N = 100$) stated that the scenery of the adjacent coastline was either important or very important ($65 \pm 9\%$) to them and preferred to see a natural (unbuilt) coastline at their dive sites ($79 \pm 8\%$) (Fig. 7).

Divers expressed broad agreement about management interventions that could help to improve the health of the reefs. Potential measures such as size limits for fish capture ($81 \pm 8\%$), limits to fishing effort ($80 \pm 8\%$), the ban on spearfishing ($79 \pm 8\%$), more laws against pollution ($79 \pm 8\%$), limits to anchoring ($79 \pm 8\%$), protection of endangered

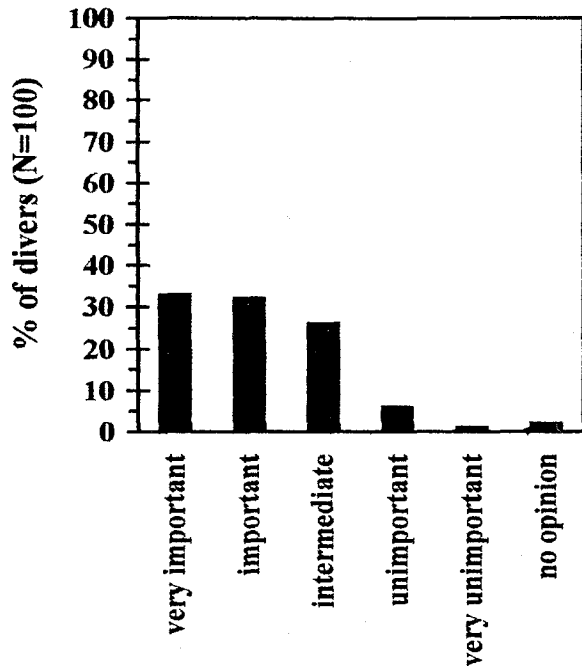


Fig. 7. "When diving, how would you rank the scenery on the adjacent coastline as a factor of importance to your enjoyment of the dive?"

species ($78 \pm 8\%$), control of fish traps ($75 \pm 9\%$), limits to coastal development ($73 \pm 9\%$), control of gill nets ($70 \pm 9\%$) and fish reserves ($66 \pm 9\%$), were all indicated as useful by a statistically significant majority of respondents. In addition, the majority ($91 \pm 6\%$) were willing to pay a fee for reef management. In the Netherlands Antilles, diver fees are currently used to finance reef management in both Bonaire (US\$ 10/yr) and Saba (US\$ 3/tank).

Boaters: The majority of the boaters interviewed ($N = 50$) had a boat in the 11-20 ft length category (32%) or in the 21-30 ft category (24%). Twenty-eight percent of the boats were classified as a motor yacht. Most boaters used their boat for boat trips, sailing or fishing, and 70% used their boat weekly. The boaters interviewed belonged primarily to the 41-50 year age class (40%). Annual expenditures on the boat, in terms of maintenance and docking exceeded US\$ 550 per year for 44% of respondents, while 32% indicated expenditures of US\$ 140-500. A statistically significant majority of respondents ($72 \pm 12\%$) said that boating safety had decreased

compared to five or more years ago. According to them this was attributed to four main factors: seadoos, high-speed boats, inexperienced navigators, and disobedience of rules.

Of those who also fished in their boats ($N = 20$), 80% felt that catch rates for reef and bottom fishing had decreased or decreased a lot over the last ten years. This, they perceived, was to a large extent due to spearfishing, pollution and overfishing in general. According to 62% of boaters with >5 years of diving experience in Curaçao ($N = 21$), coral variety and cover had either decreased or decreased a lot compared to five or more years ago. Similar opinions were expressed about the changes in fish variety, abundance and size. While these results thus corroborate those from the fisherman and diver surveys, the results were not statistically significant due to the small subsample of respondents who met the criteria for answering these questions.

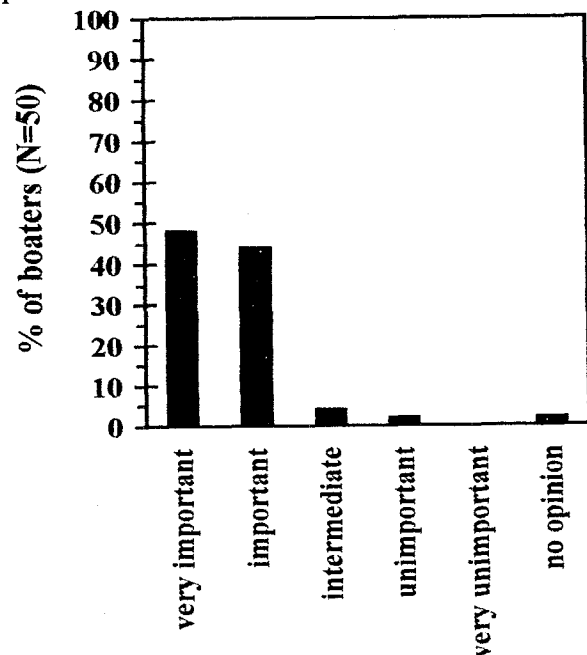


Fig. 8. "How important is the landscape of the adjacent coastline to you when using your boat and undertaking related activities?"

A statistically significant majority of boaters ($N = 50$) indicated that the landscape of the adjacent coastline (scenery) was either important or very important to them ($92 \pm$

8%) and expressed a preference ($74 \pm 12\%$) for natural scenery (Fig. 8). Potential measures such as protection of endangered species ($84 \pm 10\%$), more laws against pollution ($84 \pm 10\%$), size limits for capture ($80 \pm 11\%$), the ban on spearfishing ($80 \pm 11\%$), limits to anchoring ($76 \pm 12\%$), and limits to coastal development ($76 \pm 12\%$) were all indicated as valuable measures to introduce by a statistically significant majority of the respondents ($N = 50$). These were followed by control of fish traps ($60 \pm 14\%$), control of gill nets ($60 \pm 14\%$), fish reserves ($58 \pm 14\%$) and limits to fishing effort ($54 \pm 14\%$).

A statistically significant majority ($82 \pm 11\%$) ($N = 50$) was willing to contribute financially to reef management while a significant majority ($68 \pm 14\%$) also supported annual contributions of US\$ 30 or more (Fig. 9).

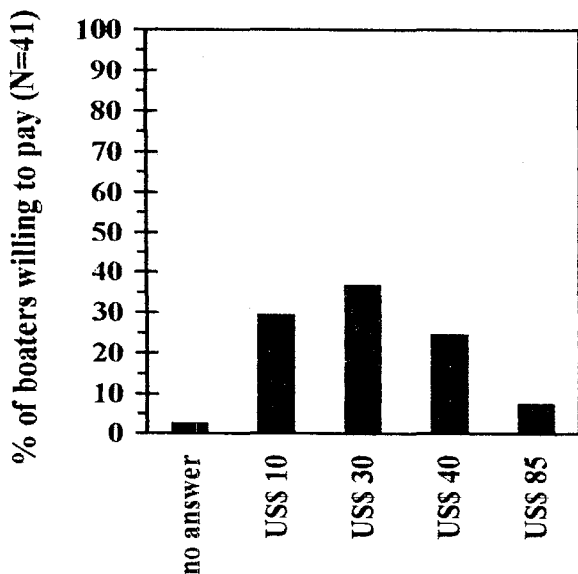


Fig. 9. "What amount do you find acceptable as an annual boater's fee, taking into account the type of boat you own?"

DISCUSSION

Thanks to government-supported nature foundations, the Netherlands Antilles has a history of wildlife conservation and relatively successful nature park management dating from the early 1960s (e.g. Sybesma 1992). Two of the most exemplary marine parks in

the Caribbean region are, for instance, the largely self-funding Bonaire Marine Park (Dixon *et al.* 1993) and Saba Marine Park (Fernandes 1995). By contrast, in Curaçao the level of marine resource conservation is poor. The Curaçao Underwater Park which was founded in 1983 with minimal funding and without legal underpinnings, has never amounted to more than a "paper" park. A rudimentary Reef Management Ordinance dating from 1976, in which spearfishing and breaking coral were the only punishable misdemeanor violations (Timmers 1979), remained, until recently, only sporadically enforced. Since 1976 the only new developments in marine resource management in Curaçao have been the legal protection of sea turtles and the elevation of spearfishing to a criminal offence, both in 1996. While in Bonaire and Saba the importance of marine conservation to development of the tourism sector has long been recognized, in Curaçao this was only recently formalized with a tourism master plan (Anonymous 1993b), accorded by Island Council in 1995. The master plan calls for improvement of the dive product by upgrading the level of reef management.

This paper forms part of the work on which a new reef management plan has been based and offers insight into the perceptions of three principal coastal resource user groups with regards to reef resource conservation state and possible management interventions. Such information allows decision makers and managers to know what kind of measures are more likely to be supported and what level of understanding the user public has with respect to different management issues. With this knowledge, problems and opportunities can be identified and management can be formulated appropriately in terms of legislation, general information and educational programs.

The present surveys not only document wide awareness of the deterioration of reef resource condition and likely contributing causes, but also wide agreement on the need-

ed measures and a general willingness to contribute financially to management through fees and licenses. The results thus show that there is broad support from key resource user groups for improved coastal resource management in Curaçao.

Until now a major impediment to needed change had been the assumption by government agencies and elected officials that users are against intensified coastal resource management (L. Pors, Curaçao Underwater Park, pers. comm.). The long-overdue legal protection for sea turtles which was painlessly introduced in 1996 (following this survey), provides additional evidence that this assumption is unfounded. Curaçao thus is in the lucky position that coastal resource users are quite aware of recent declines and prepared to support reef management.

This encouraging outcome may be attributed jointly to such factors as the low importance of reef catches relative to pelagic catches, the high per capita GNP, the fact that most fishermen have principal sources of income other than fishing, the high literacy rate of the population, the many years of educational activities by the National Parks Foundation and environmental groups, and the successful examples of Bonaire and Saba. For comparison, Heinen (1993) documents a case in which user attitudes with respect to nature conservation for a park in Nepal appeared to be related to literacy rate and ethnic group but not to socio-economic standing.

To maintain broad user support it would seem critical to choose regulations in such a way that all user groups will somehow benefit. This is often difficult, especially for extractive resource users (in this case fishermen). The latter group typically has a greater ecological impact on the resource than non-extractive user groups and often has to carry the greater burden of restrictions. However, in a case of major depletion such as in Curaçao, both extractive and non-extractive resource users can expect palpable gains from improved conservation (*e.g.* McClanahan and Kaunda-Arara 1995, Rakitin and Kramer

1996, Roberts and Hawkins 1997) and need to be convinced of this.

During interviews, the main objective of management was presented as being resource conservation, but it was conceded to fishermen that they too could expect perceptible benefits in terms of reduced user conflicts, improved catch rates and larger average fish sizes. It was also clearly stated that user funds would be designated to implement measures which the respondents had indicated as being needed. Obviously, continued cooperation by fishermen and other user groups will depend on management's ability to deliver perceptible benefits. However, benefits alone are not enough for continued support by a user group, as documented by Heinen (1993). Critical to sustained support are both the need for continuous monitoring of key biological and socio-economic indicator parameters of management success and for effective public relations, interpretation and environmental awareness education.

Notwithstanding, fishermen can be expected to be the most difficult of the three user groups to keep on good terms. One strategy by which to ease introduction of those regulations directed at fishing might be to partially compensate these by inclusion of popular measures as part of a total package. From our surveys these would especially include the deployment of more fish attracting devices, which are considered a boon by most fishermen familiar with them, and high profile enforcement against poaching by large foreign vessels (especially Venezuelan tuna purse seiners).

In light of documented public support for marine resource management on other islands of the Netherlands Antilles (Scura and van't Hof 1993, Fernandes 1995) our findings are not totally unforeseen, but do carry significant management implications. Aside from resource user support, other key constraints to management include a basic understanding of the reef ecosystem, institutional capacity, finances, sustained stakeholder involvement and the quality of governance. The presence

of a biological research station readily fulfills basic management requirements for expertise and information on reef ecology, while supplemental institutional capacity needs have been identified and can largely be funded by user fees based on current user numbers (van't Hof *et al.* 1995). Stakeholder involvement can be achieved through co-management and user outreach. However, co-management may be difficult to implement to any significant degree considering inherent socio-cultural factors such as the generally undemocratic nature, low motivation, apathy and passivity of the population (*e.g.* Schrijs 1990, Römer 1998). Interviews with representatives of 28 different organizations (both governmental and non-governmental) with links to reef management gave general endorsement for some form of co-management at the policy level but, not surprisingly, indicated the need for a single executive organization (Hof van't *et al.* 1995). Another constraint is the quality of governance. In recent years, governments in Curaçao appear to have been chronically plagued by a general inability to make important decisions and coherently implement them (Debrot and Sybesma *in press*). Environmental legislation is no exception and, compared to key benchmark nations, lags decades behind (Anonymous 1998b). For Curaçao then, poor governance may be the single greatest threat to modern coastal resource stewardship. Results indicate that user support and other conditions for the introduction for improved reef management legislation are good. Good governance, in turn, will mean the ability of government to recognize this opportunity and act upon it.

Finally, the results from the questions to boaters and divers indicating the significance of natural (unbuilt) coastlines to their recreational experience are particularly noteworthy. Diving and boating are apparently experienced as outdoor and nature-oriented experiences and a natural setting was indicated by users as important to the overall quality of that experience. Independent surveys conducted by CTDB in 1994 further indicate that

the majority of beach visitors (77.9%) considered a nature trail to be very important, scoring higher than all other recreational facilities for public beaches (Anonymous unpubl.). These findings are in clear support of government initiatives to protect natural coastlines by means of land use planning as delineated in the Island Development Plan for Curaçao (Anonymous 1995).

The overall conclusions are that there is wide awareness of a decline in coastal resource values and broad user support for major reef management measures in Curaçao. A review of other main constraints shows that conditions are quite favorable for implementation of new legislation. Modern coral reef management is urgently needed to safeguard a key natural resource and concerted action is called for on the part of government agencies, legislators and elected officials.

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RESUMEN

Mediante encuestas a 250 usuarios de recursos costeros se evaluó la percepción sobre necesidades administrativas de la costa de Curaçao. Se halló tasas generalmente superiores al 70 % de apoyo a diversas medidas que restringen la pesca de invertebrados y peces, así como la construcción de edificios en la costa. El concep-

to de que el usuario debe pagar por los recursos que utiliza fue bien recibido y esto debe ser tomado en cuenta por las autoridades ante la urgente necesidad de medidas protectoras del ambiente en esta región.

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