



Original research article

Fisher and diver perceptions of coral reef degradation and implications for sustainable management

Ayana Elizabeth Johnson^{a,b,*}, Jeremy B.C. Jackson^{a,c,d}^a Center for Marine Biodiversity and Conservation, Scripps Institution of Oceanography, University of California, San Diego, 9500 Gilman Drive, La Jolla, CA 92083-0202, USA^b Waitt Institute, 1201 Connecticut Ave. NW, Floor 3, Washington, DC 20036, USA^c Department of Paleobiology, National Museum of Natural History, PO Box 37012, Washington, DC, USA^d International Union for Conservation of Nature, 1630 Connecticut Ave. NW, 3rd Floor, Washington, DC, 20009, USA

HIGHLIGHTS

- We interviewed fishers and divers on extent and causes of reef degradation.
- Fishers know fish are severely depleted. Divers consider the reefs healthy.
- Fishers and divers differ in perceptions of causes and remedies for decline.
- Most fishers and divers support more management of both fishing and diving.
- The social climate is ripe for balanced restrictions on reef use.

ARTICLE INFO

Article history:

Received 9 January 2015

Received in revised form 3 April 2015

Accepted 4 April 2015

Available online 17 April 2015

Keywords:

Artisanal fishing

SCUBA diving

Coral reefs

Reef management

Resource degradation

Shifting baselines

ABSTRACT

Fishers and divers are the major resource users of Caribbean coral reefs. On Curaçao and Bonaire, reef condition is good relative to the Caribbean average, but fishes and corals have greatly declined over the last few decades. We interviewed 177 fishers and 211 professional SCUBA divers to assess their views on the extent and causes of degradation. Fishers know fish stocks are severely depleted and declining, whereas divers were aware of declines but had “shifted baselines” and consider the reefs healthy. Fishers and divers differ in perceptions of the causes and appropriate remedies for decline. Fishers generally blame external factors such as changes in climate, currents, or industrial fishing offshore, whereas divers primarily blame overfishing and coastal development. Nevertheless, the great majority of both fishers and divers support more management of both fishing and diving. Thus the social climate is ripe for balanced and strong restrictions on both groups for reef recovery and sustainable use. Exclusion of both fishers and divers from protected areas of significant size around the islands would be a major step forward towards the long-term conservation of reef resources.

© 2015 The Authors. Published by Elsevier B.V. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

1. Introduction

Caribbean reefs are severely degraded due to overfishing, coastal development, pollution, and climate change (Jackson, 1997; Hughes et al., 2003; Pandolfi et al., 2005; Jackson et al., 2014). However, building stakeholder support for managing

* Corresponding author at: Waitt Institute, 1201 Connecticut Ave. NW, Floor 3, Washington, DC 20036, USA.

E-mail address: ayana@waittinstitute.org (A.E. Johnson).

human impacts is hindered by ignorance of the severity of degradation relative to pristine conditions. This is the problem of “shifting baselines” that plagues understanding of all forms of environmental change, lowering our standards for what healthy ecosystems look like (Pauly, 1995; Jackson et al., 2011).

Shifting baselines are a problem for industrial fisheries because catch limits are set based upon modern scientific data obtained long after fishing began. Similar problems exist in artisanal fishing communities; more experienced fishers usually consider a greater number of species depleted, note earlier dates for the onset of depletion, and are more likely than less-experienced fishers to notice species declines (Sáenz-Arroyo et al., 2005; Ainsworth et al., 2008; Bunce et al., 2008; Godoy et al., 2010). Few scientists or recreational divers have ever seen a healthy reef and have little basis for understanding the effects of coastal development and tourism, such as damage to corals by divers (Hawkins et al., 1999; Barker and Roberts, 2004).

Here we use the Caribbean islands of Curaçao and Bonaire as a case study to explore stakeholders’ perceptions of reef fish populations and reef health, and to inform future management. Through extensive interviews of artisanal fishers and professional SCUBA divers, we identified the effects of age, profession, island of residence, and years of experience on (1) expectations for abundance; (2) perceived causes of changes in fish abundance and reef condition; and (3) support for management measures. To our knowledge, this is the first comparative study on the ecological baselines of fishers and divers.

1.1. Local history of fishing and diving and coral reefs

Research was conducted in 2009 and 2010 when Curaçao’s resident population was approximately 142,000 versus 13,400 on Bonaire (Central Bureau of Statistics, 2010). Artisanal fishing has occurred on both islands for several hundred years without industrialized fishing or significant exportation. Dive tourism began on both islands in the 1960s. Tourism is the primary economic activity on both islands, especially on Bonaire whose economy is largely dependent on recreational diving (Bouchon et al., 2008). Approximately 44% of Bonaire’s tourists buy tags that allow them to dive (over 31,000 tags sold in 2010; Tourism Corporation Bonaire, 2011). Comparable data are unavailable for Curaçao.

The number of fishers on Curaçao has declined from 652 in 1959 (Zaneveld, 1961), to 390 in 1994 (Dilrosun, 2001), to about 200 today (50 full-time and 150 part-time). There are around 30 full-time and 50 part-time fishers on Bonaire; historical numbers are unavailable but anecdotal evidence suggests a several fold decrease. The fishers are largely owner-operators, or working in small groups of one to three crew with a captain. There are around 130 professional SCUBA divers on Curaçao and 120 on Bonaire, spread amongst approximately 40 dive shops.

Average Caribbean coral cover has declined from 35% to 16% since 1970 (Jackson et al., 2014). Coral cover in Curaçao and Bonaire is approximately double this modern Caribbean average but has declined markedly. Fish data are limited but most Caribbean reefs are severely overfished. Wells (1988) reported “overfishing, especially illegal spearfishing,” in Curaçao, versus Bonaire where large fish were “far more abundant,” and “lacking signs of over-exploitation.” More recently, mean fish biomass on the two islands was estimated at 135 g/m², with higher values on Bonaire than Curaçao (Sandin et al., 2008; M. Vermeij pers. comm.). Less than 7% of the biomass was apex predators, and no sharks were observed (Sandin et al., 2008). Spearfishing caused sharp declines in parrotfish populations, although Bonaire banned take of parrotfish in 2010 (Steneck et al., 2011). For context, Caribbean fish biomass ranges from as little as 15 g/m² in Jamaica to nearly 600 g/m² in Cozumel (Newman et al., 2006), with large groupers and snappers virtually absent, and most reefs dominated by smaller species (Pandolfi et al., 2003; Jackson et al., 2014).

Anecdotes from interviewed fishers and divers echo the scientific evidence for sharp declines in fish since the 1980s. In variations on a theme, interviewees express how “the coast is a desert now” compared to what they observed or to stories they have heard. Spear fishers reported having behaved as if “the reef was a supermarket,” choosing what they wanted, and catching goliath groupers almost their own size (Fig. 1(a)), or a half dozen Nassau and other groupers (Fig. 1(b)). Large groupers are now rare, spearfishers’ catches are dominated by parrotfish (Fig. 1(c)), and two experienced spearfishers using SCUBA were unable to catch a single large grouper or snapper in two dives (Fig. 1(d); A.E.J. pers. obs.). The shift to targeting parrotfish is of particular concern because of their role cleaning the reef of macroalgae that suppress coral recruitment, growth, and survival (Jackson et al., 2014).

Records of hook-and-line catches tell a similar story. In the 1950s, a line fisher in nearshore waters would typically catch 9 to 23 kg of mostly large groupers and snappers (Zaneveld, 1961), but by 1995, 75% of fishers on Curaçao reported catching less than 5 kg per day (unpublished appendix to Debrot and Nagelkerken, 2000). By 2001 the average was down to approximately 4 kg per day (Dilrosun, 2001). There are no time series data of catch landings on either Curaçao or Bonaire.

2. Methods

In the fall of 2009 on Curaçao and in the spring of 2010 on Bonaire, the first author interviewed 177 full-time and part-time fishers, and 211 professional SCUBA divers, including dive instructors, dive masters, and dive guides. All fishing there can be considered small-scale or artisanal (there is no large-scale industrial fishing or exportation of fish), so here we consider all interviewed fishers as a single group. English–Papiamentu–Dutch translators were used for all fisher interviews, but were unnecessary for divers who all spoke English.

Lack of comprehensive lists of fishers and divers precluded stratified random sampling, so considerable effort was made to include fishers at every port and divers at every shop, to interview fishers and divers of all ages, and to conduct as

Download English Version:

<https://daneshyari.com/en/article/4379612>

Download Persian Version:

<https://daneshyari.com/article/4379612>

[Daneshyari.com](https://daneshyari.com)