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Reef Perspectives: ESA Coral Species Listing

REEF PERSPECTIVES

Personal comment on reef science, policy and management

E.S.A. CORAL SPECIES LISTING: A ROADBLOCK TO COMMUNITY-BASED ENGAGEMENT IN CORAL REEF CONSERVATION AND REHABILITATION ACROSS THE U.S. CARIBBEAN?

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Coral reef ecosystems have declined globally driven by multiple local-scale human stressors and large-scale climate change-related factors, which can produce a combination of acute, stochastic events, and long-term, slowly-evolving changes (Côté and Darling 2010, Hughes *et al*. 2013). Mounting evidence points to the wider Caribbean region as one of the most susceptible to rapid ecosystem resilience decline (Rogers and Miller 2006, Roff and Mumby 2012, Rogers 2013). This has often resulted in a long-term decline in percent live coral cover, species diversity and a widespread phase shift in benthic community structure (Hughes 1994, Miller *et al*. 2009, Edmunds 2013), with limited recovery ability (Hughes and Tanner 2000, Birkeland *et al*. 2013). It has also resulted in the demise of susceptible coral functional groups such as Atlantic acroporid corals (Bruckner and Hourigan 2000) and a major loss of coral reef ecosystem resilience, functions, benefits, services, and socio-economic value (Bellwood *et al*. 2004), including the ability to sustain fisheries (Pauley *et al*. 2002, Pauley and Zeller, 2014, Pratchett *et al*. 2014).

Nonetheless, a recent burst of various efforts at a global scale using low-tech coral farming and outplanting approaches have produced modest positive and highly promising results of propagating corals aimed at rehabilitating coral reefs and buffering their current trends of decline (Rinkevich 2014). Ecosystem rehabilitation can be defined as the recovery of specific ecosystem services in a degraded ecosystem or habitat. It seeks to repair damaged or blocked ecosystem functions, with the primary goal of raising ecosystem productivity for the benefit of local people (Aronson *et al*. 1993). In that sense, low-tech coral farming, which implements simple, low-cost, effective methods, seek to achieve reef rehabilitation of a set of minimum ecosystem functions as rapidly as possible using rapid-growing coral species.

Staghorn coral (*Acropora cervicornis*) farming in the Caribbean was first undertaken experimentally in 1980 in Puerto Rico by the late Carlos Goenaga and Vance P. Vicente. It was further developed by Bowden-Kerby (1997), Antonio Ortiz and Héctor Ruiz over the late 1990s, and has continuously been conducted in Culebra Island, off eastern Puerto Rico, since 2003, as an entirely community-based effort led by NGO Sociedad Ambiente Marino, in collaboration with NGO Coralations, the Culebra Island Fishers Association, and the Center for Applied Tropical Ecology and Conservation (CATEC) of the University of Puerto Rico (Fig. 1). Since then, multiple efforts have sprouted across the wider Caribbean region, including Puerto Rico, U.S. Virgin Islands, Belize, Jamaica, Dominican Republic, and Florida, to mention a few (Young *et al*. 2012). But these efforts have mostly been limited to smaller spatial scales and mostly focused on *A. cervicornis* largely due to logistical, technical and/or economic limitations.

There is widespread consensus across the Caribbean that people of coastal communities can effectively conduct low-tech coral farming, develop activities to

conserve and rehabilitate their local reefs, and promote community-based management of local resources through continued public education and awareness (Young *et al*. 2012), and hands-on experiences. Our particular twelve year-old experience in coral farming and outplanting in Puerto Rico through the *Community-Based Coral Aquaculture and Reef Rehabilitation Program* has unequivocally showed that community-based approaches have become a paramount tool to assist regulatory agencies and management institutions to enhance coral reef recovery and conservation through coral farming project outcomes (Fig 2). Community engagement can also foster enhanced stewardship and multiple educational/outreach benefits, and increase the level of technical training of local personnel. This has resulted in empowering and helping local communities and stakeholders to manage their coastal resources, which in the long run will result in improving their skills to protect their first line of defense against climate change and sea level rise.

Figure 1. Low-tech Staghorn coral *Acropora cervicornis* farming unit in Culebra Island, Puerto Rico. Rapid coral growth in farms results in the ability to produce multiple large fragments (20-50 cm) for outplanting to natural reef bottom.

The Culebra Island case study

In the particular case of Culebra Island, an important tourism destination located 27 km off eastern Puerto Rico, halfway between Puerto Rico and St. Thomas, USVI, coral farming and reef rehabilitation have triggered a major blooming of community-based low-impact tourism activities on local rehabilitated coral reefs within Canal Luis Peña No-take Natural Reserve.

Figure 2. The "Coral Condo" farming units supports outstanding coral growth and significant coral reef fish aggregations.

In this case, the no fishing designation has been implemented in combination with restocking of approximately 12,000 colonies of *A. cervicornis*. This has triggered a rapid increase in fish biomass, fish recruitment and herbivory across rehabilitated reef segments (Fig. 3). Such benefits would be particularly critical for developing nations and small island countries with very limited technical and financial resources available for management. Therefore, community-based participation in conservation- and management-oriented coral farming and reef rehabilitation activities has become a key component of modern coral reef day to day management strategies in a time of increasing socio-economic constraints and increasing climate change threats to the recovery and sustainability of reef ecosystem resilience. It represents a win-win situation for regulatory agencies, academia and the communities themselves, resulting in an increased direct involvement of multiple stakeholders in the decision-making process. It may also result in improved process transparency, communication and trust-building, and in building stronger partnerships with multiple, often non-traditional sectors, further improving community-based support, stewardship and compliance with marine protected areas (MPAs) and other regulations.

Regulatory changes

Recent efforts across the US Caribbean led by the National Marine Fisheries Service (NMFS) resulted in the designation of Elkhorn coral (*Acropora palmata*)

Figure 3. Coral outplanting has resulted in a rapid increase in the abundance of recruits of commercially important fish families, such as Haemulidae, Lutjanidae and Serranidae. It has also fostered increasing densities of juveniles of important herbivore guilds, including Scaridae and Acanthuridae.

and Staghorn coral (*A. cervicornis*) as threatened species in 2006 under the Endangered Species Act (ESA), establishing very strict regulations regarding the conservation of both species. Critical habitats were designated in 2008, but species recovery plans have not been produced yet for either species. NMFS is now considering reclassifying both species as endangered, as well as listing Cactus coral (*Mycetophyllia lamarckiana*), Pillar coral (*Dendrogyra cylindrus*), and Star corals (*Montastraea annularis*, *M. faveolata*, *M. franksi*), which were recently reclassified under genus *Orbicella* (Budd *et al*. 2012). If these species are eventually listed as endangered, there would be a completely new set of highly restrictive rules related to research involving any of these species, including coral farming and reef rehabilitation activities.

Endangered corals listing: Achieving coral protection or roadblocks to community-based engagement?

Preparing to conduct research on coral species potentially designated as endangered under ESA has already been deemed as significantly burdensome to the scientific community as a result of the extra administrative steps that will be required to apply for research permits (Weijerman *et al*. 2014). On this sense, NMFS initiated during 2013 a new process requiring all coral farmers across the U.S. Caribbean to request a new permit under section 10 of ESA for conducting coral farming or reef rehabilitation and/or restoration activities with acroporids or any of the candidate species for listing, even though no corals have been listed as endangered yet. This will involve an onerous, time-consuming, tedious, complex, and highly technical and bureaucratic permit application process. NMFS also requires applicants to provide evidence of their academic background and peer-reviewed publications history, which raise the concern that most community-based coral farmers might get automatically excluded from even applying for a permit by failing to comply with strict academic credentials. To complicate the situation, the U.S. Navy Corps of Engineers is now threatening to take legal action against coral farmers across the U.S. Caribbean by claiming that low-tech coral farming units are not in compliance with existing regulations of permitted uses in U.S. navigable waters. This would further represent an extra burden for small community-based coral farmers, besides rendering them legally liable for any incident with coral farms under their custody, potentially resulting in overwhelming expenses in insurance. At the local level in Puerto Rico, there are also new efforts by the PR Department of Natural and Environmental Resources (PRDNER) to restrict State permits to applicants which can show evidence of already available funding to conduct projects. The catch-22 here is that Federal funding agencies often require evidence of *a priori* approved permits from regulatory agencies to conduct coral farming and transplanting activities before allocating funds. Therefore, the proposed changes in the qualifying regulations at the Federal and State level (in Puerto Rico) could have the long-term effect of becoming major roadblocks to community-based initiatives and participation in coral farming and reef rehabilitation activities, in spite of their proven success.

If the proposed coral species are listed as endangered under ESA, it may certainly represent the highest level of Federal legal protection within the U.S. Caribbean for any declining species. Nonetheless, it may also represent a major step backwards for community-based participation and integration in managing natural resources as new legal requirements will make this task nearly impossible to undertake for most non-

scientific stakeholders. Community-based coral farming and reef rehabilitation initiatives in Puerto Rico have already been of significant and novel value to the conservation and rehabilitation of U.S. coral reef ecosystems (Fig. 4). Benefits include providing baseline guidance to reef managers and decision-makers regarding the ecosystem-level benefits of coral farming and reef rehabilitation efforts, and providing critical quantitative baseline information to parameterize coral population models to guide future Acroporid corals restocking, which will provide guidance for testing future rehabilitation efforts across other Caribbean reefs. These efforts have also resulted in integrating local stakeholders into successful management practices, improving local stewardship and support, building stronger trust, reviewing and amending existing MPA management plans, and developing a set of minimum guidelines to drive future management-oriented decision-making processes, including reef rehabilitation efforts to maximize their ecosystem-level impacts.

Figure 4. Twelve-year old outplanted colony of ESA candidate Star coral *Orbicella faveolata* in Culebra Island, Puerto Rico. Under proposed new rules across the US Caribbean successful community-based coral propagation initiatives such as this would become very difficult to achieve due to burdensome permit application procedures.

A call for precaution

Community-based low-tech coral aquaculture and reef rehabilitation approaches in Puerto Rico have proven to be successful, reliable and highly cost-effective tools to conserve and restore Staghorn coral populations with minimum intervention and maintenance, and should not be deemed as minimal. These tasks have always been carried out in support of State and Federal management efforts to conserve and restore local coral reefs, and have been recognized by the U.S. Coral Reef Task Force. The *Community-Based Coral Aquaculture and Reef Rehabilitation Program* has been a successful model to empower wider Caribbean community stakeholders in basic coral reef conservation and coral transplanting methods, with major implications in helping base communities to engage in conservation-oriented coral reef management and to adapt and manage climate change impacts on their "backyard" coral reef ecosystems.

Hands-on and behavior-modifying, transformative education, associated with these activities, is a crucial product of base community-academia integration and their active participation, improving local stewardship. Adaptive responses in low-tech coral farming and reef restoration will be critical to keep up with climate change in the near future. They could also be used to promote the rehabilitation of reef ecosystem's resilience, biodiversity, ecological functions, and services, as well as their socio-economic, ecological and environmental benefits. This is a model project of successful integration of academia, NGOs, fisher communities, base communities and stakeholders that can be applied throughout the wider Caribbean region and elsewhere. Such collaborations will be important in a time of economic constraints across developing small island nations. But stronger and successful trust-building, and stakeholder participation and integration can only be achieved through transparent, participatory processes and not through legal actions aimed at perpetuating unpopular, often non-functional, top-down management approaches which might result in a significantly limited community-based participation. Such top-down approaches may cause problems and potential rejection by small-island based communities which have shown a long tradition of strong engagement in multiple coral reef conservation efforts, and should be carefully reviewed and reconsidered before a final decision is made.

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