Rethinking Coastal Recreational Fisheries Management for 2020: Using the Florida Shallow Water Recreational Fishery as a Case Study

Reconsiderando el Manejo de la Pesca Recreativa Costera en 2020: El Caso de la Pesca Recreativa de Poco Profundidad de la Florida, USA

Repenser la Gestion des Pêches Récréatives Côtières à l'Horizon 2020 : À l'Aide de la Pêche Récréative de l'Eau peu Profonde en Floride comme Étude de Cas

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EXTENDED ABSTRACT

To sustain coastal recreational fisheries, many processes must be managed for. These include:

i) Fishing mortality, which is a function of both harvest and discard mortality,
ii) Habitats and their ecological functions across all life stages, and
iii) Fish health (Figure 1).

Despite the multi-faceted needs of successful recreational fisheries management, traditional management generally focuses on regulating harvest by using tools such as slot limits, bag limits and seasonal closures to conserve a species, thereby ignoring the other factors.

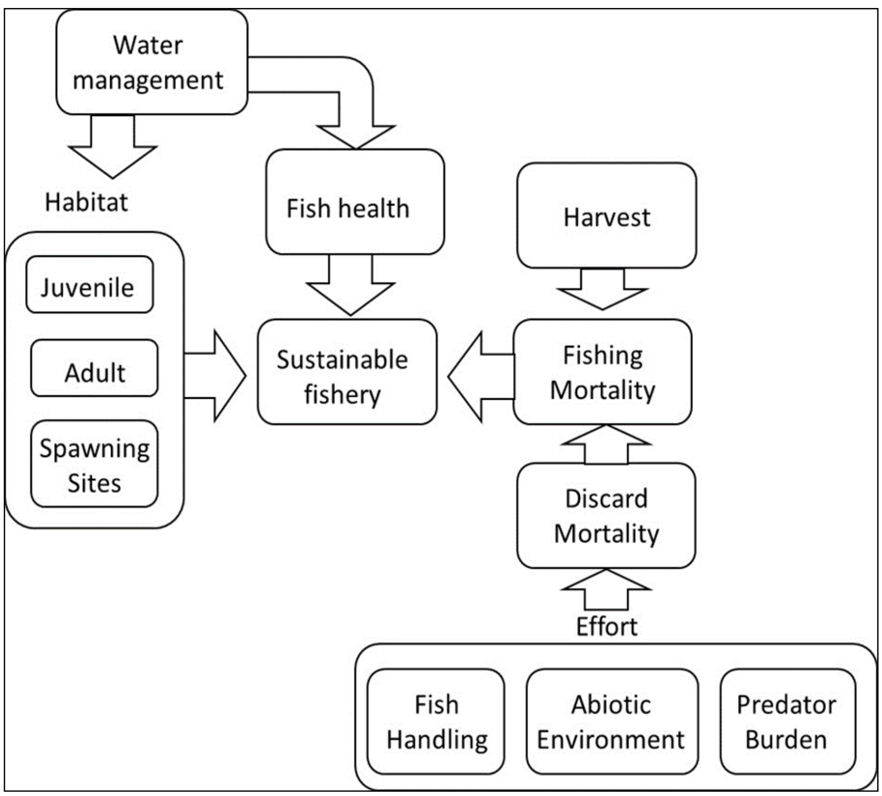

Figure 1. Conceptual model of processes that influence the productivity of fisheries

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Numerous pressures unrelated to harvest are stressing important coastal recreational fisheries. These include coastal development and associated habitat degradation and loss (Barbier 2002), freshwater mismanagement (Gillson 2011), and steadily increasing fishing pressure (Post 2002). Examples of these stressors are apparent in Florida's shallow water recreational fisheries, most notably common snook (*Centropomus undecimalis*), permit (*Trachinotus falcatus*), bonefish (*Albula vulpes*) and Atlantic tarpon (*Megalops atlanticus*). In Florida, the shallow water fishery for bonefish and permit only exists in the Florida Keys (Latitude 26^{o} - Latitude 24^{o} N), the snook fishery occurs throughout south Florida (Latitude

28° N- Latitude 24° N), and the tarpon fishery occurs seasonally throughout Florida's coastal waters (Latitude 38° N- Latitude 24° N). All four species are tropical in evolutionary origin, occur throughout the Caribbean basin and drive extremely lucrative catch and release fisheries (Adams et al. 2012). For instance, the shallow water fishery in the Florida Keys, which is largely supported by these species, generates approximately $465 million (USD) each year in economic impact (Fedler 2013). Likewise, in Belize and in the Bahamas, flats fisheries generate $50 million, and $150 million per year, respectively, in economic impact (; Fedler 2011, Fedler 2013). In Florida, harvest for bonefish and tarpon is illegal. For snook, harvest is tightly regulated by size limits and seasonal closures with a harvest rate of less than 10%. Permit benefit from strict harvest regulations in the Florida Keys where the shallow water fishery exists (Myfwc.com).

Despite these fisheries being predominately catch and release, anecdotal and scientific reports suggest that the populations of these four species are stressed or in decline. In the Florida Keys, the probability that an angler targeting bonefish will successfully catch a bonefish has decreased from a 60 - 70% chance per day in the early 1990s to less than 30% in 2012 (Santos et al. 2017). For snook, spawning stock biomass is stable; however, recruitment is declining on the east coast of Florida (Muller et al. 2015). Population trends for tarpon and permit have not been evaluated, but angler reports suggest that these fisheries are also declining.

"*We see half as many permit as we did 15 years ago, it is getting really bad,*" says Capt. Doug Kilpatrick; Commodore of the Lower Keys Guides Association.

We highlight three drivers unrelated to harvest that are likely playing some role in these declines;

i) Habitat loss/degradation,
ii) Freshwater mismanagement, and
iii) Increasing effort and discard mortality.

Habitat Loss and Degradation

For snook and tarpon, mangroves are vital nursery habitats (Barbour et al. 2014). Across the globe, 35% of mangrove habitats have been lost to development with a 3% decline each year (Valiela et al. 2001), Florida is no exception, where an estimated 50% of mangroves have been lost or degraded. Degradation of juvenile snook and tarpon habitat causes reduced growth, with impacts on survival (Adams et al. 2009; Wilson et al. 2019). Although the effect of juvenile habitat loss and degradation on snook and tarpon fisheries has not been evaluated, but is likely detrimentally impacting the adult fisheries. The sandy beaches that serve has habitat for juvenile permit, are subject to regular beach nourishment practices that alter prey communities, impair visual feeding, and attract predators (Wilbur et al. 2003; Manning et al. 2013). Florida has spent over $100 million over the last three years on beach nourishment and uses this tool statewide (National Beach nourishment database 2018), which ultimately impacts the natural functions of these beaches that serve as juvenile permit habitat. Protecting habitats and their ecological functions must be prioritized. If habitats are lost, the ceiling of productivity for a fishery will decrease. Further, habitat restoration actions are often limited in success, are expensive, and take years to result in improvements to higher trophic level species.

Freshwater Management

Alterations that affect timing, quantity, quality, and spatial characteristics of freshwater flows into estuaries can degrade habitats, and incur harm to fish health (Gillson 2011). Severely altered freshwater flows to Florida's estuaries are degrading habitats that support Florida's shallow water fisheries. For example, major estuaries in southeast and southwest Florida receive far more freshwater than they did historically, at the expense of Florida's southernmost estuaries that receive 45% less than they did historically (Sklar et al. 2005).

The lack of freshwater entering the southern systems causes predictable hypersaline events during droughts, triggering system-wide seagrass die-offs. The most recent die-off occurred in 2015, killing over 50,000 acres of grass, turning a clearwater-seagrass dominated system into a murky algal dominated system (Hall et al. 2017). Cascading from these die-offs, cyanobacterial blooms also cause large-scale sponge mortality events. Ecological recovery from these die-offs last 20 years (Hall et al. 2017). This recent freshwater alteration-induced event was a repeat of an event in the early 1990s. Both events had negative impacts on the bonefish population (Santos et al. 2017).

Estuaries on Florida's east and west coasts receive pulses of nutrient rich water from numerous sources, including upstream agriculture, groundwater contaminated by poor wastewater infrastructure, storm runoff, biosolid deposition, and other anthropogenic sources. These releases correlate with the frequency, timing, intensity, and spatial coverage of harmful algal blooms. On the west coast, concentrations of *Karenia brevis* have increased by orders of magnitude from the 1960s to the early 2000s (Brand and Compton 2007). *K. brevis* blooms occur approximately every 10 years and kill over 1 million kilograms of fish and other marine fauna including snook and tarpon (Kirkpatrick et al. 2004; Brand and Compton 2007). An ongoing, 18 month long harmful algal bloom has cost the affected area approximately $150 million a month in lost tourism revenue. Similar impacts are felt on the east coast due to brown tides and cyanobacteria blooms.

Discard Mortality

At pre-spawning locations, discard mortality via depredation and post-release predation for tarpon is approximately 8% (Guindon 2011). Depredation and post-release predation of snook at pre-spawning and spawning locations by sharks and cetaceans has repeatedly been voiced by anglers as a conservation concern (Boucek et al. 2019). Last, depredation by sharks on permit at important spawning aggregation sites has been observed at approximately 30%. Due to effective conservation measures of top predators such as sharks, large piscivores like goliath groupers (*Epinephelus itijara*) and cetaceans, the abundance of these species are the highest recorded in 30 to 50 years (Peterson et al. 2017). Therefore, fisheries management must take into account the increased predator burden. The most effective management action to reduce discard mortality is to explicitly regulate fishing effort.

Conclusion

How we manage for sustainable marine fisheries has evolved over the last 300 years. Early on, the ocean was considered a limitless bounty that was impossible to exhaust. Following World War II, it was obvious that fish stocks were declining due to overfishing. To counter overfishing, the concept of maximum sustainable yield (MSY) was introduced. Now, out of necessity, we need to develop our third generation of fisheries management. This iteration must include more holistic approaches that explicitly addresses habitat protection, habitat rehabilitation, and regulation of fishing effort.

KEYWORDS: Recreational fishing, habitat, freshwater management, fish health

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