Status-quo management of marine recreational fisheries undermines angler welfare

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Recreational fisheries can have a significant impact on fish populations and can suffer from the same symptoms of open access as commercial fisheries. However, recreational fisheries receive little attention compared with their commercial counterparts. Regulations designed to allocate scarce fish, such as seasonal closures and bag limits, can result in significant losses of value to anglers. We provide an estimate of these foregone benefits by estimating the potential gains to implementing management reforms of the headboat portion of the recreational red snapper fishery in the US Gulf of Mexico. This fishery has suffered from a regulatory spiral of shortened seasons and lowered bag limits in spite of rebuilding stocks. We gather primary survey data of headboat anglers that elicit trip behavior and their planned number and seasonal distribution of trips under status-quo and alternative management approaches. We use these data to estimate a model of anglers' seasonal trip demand as a function of the ability to retain red snapper, bag limits, and fees. We find that a hypothetical rights-based policy, whereby vessels with secure rights to a portion of annual catch could offer their customers year-round fishing in exchange for lower per-angler retention and increased fees, could raise the average angler's welfare by $139/y. When placed in the global context of recreational fishing, these estimates suggest that status-quo management may deprive anglers of billions of dollars of lost economic value per year.

recreational fisheries | management reform | rights-based management | recreational demand

Commercial fishery management institutions have received much scrutiny by researchers—with analyses demonstrating the risks of overdepletion and economic waste under common forms of management (1, 2) and the opportunities for reform (3). Research has demonstrated how the adoption of "rights-based" forms of management that provide fishermen incentives to consider the value of the stocks they exploit has, when implemented with biologically sound and enforced limits on catch, enhanced profitability (4), improved manageability (5, 6), and fostered biological sustainability (7).

Recreational fisheries management has attracted much less attention. However, recreational fisheries provide a significant source of leisure, supplementary nutrition (8), and connection to nature, with 9.6 million marine anglers taking 63 million fishing trips per year in the United States (9). These trips contribute economic value and support employment in coastal economies (10). Recreational angling is also a significant and growing source of fishing mortality in many developed (11–13) and developing nations (14) and has played a significant role in the depletion of specific fisheries (15, 16). In the early 2000s US recreational fishing contributed 23% of landings among marine fish populations that were overfished or experiencing overfishing (15).

Recreational fisheries have experienced little of the policy transformation seen in many commercial fisheries. Most operate under regimes of nominal license fees and season, size, and retention constraints. These measures fail to adjust to anglers' adaptive behavior and provide little incentive for anglers to reduce their effort (17, 18). As a result, they have done little to contain fishing mortality in popular sport fisheries (19–22). Instead, many recreational fisheries are caught in a spiral of shorter seasons and increasingly tight regulation as seen in many regulated open access commercial fisheries (23). Even biologically "sustainable" management may erode angler welfare in ways that jeopardize socioeconomic sustainability. These include excessive participation (18, 24, 25), congestion during brief fishing seasons (26), and inefficient allocation of scarce harvest to anglers with low valuations through the blunt instruments of inflexible bag limits (27) and short seasonal openings (28, 29). Realistic, rights-based reforms to address these shortcomings have been suggested—including catch shares for for-hire fleets serving recreational anglers (17) and harvest tags and rights to angler days for private anglers (29, 30)—but remain largely unexplored in marine settings.

Large-scale estimates of the costs of status-quo management for recreational fisheries and the benefits of management reforms (3) are not currently feasible given scarce and inconsistent data and the heterogeneous and privately held values anglers attach to recreational fishing. In lieu of a global analysis we use angler survey data from a culturally and economically important recreational fishery for red snapper in the US Gulf of

Significance

Marine recreational fisheries are culturally and economically important around the world. However, they often suffer from management that promotes short seasons, congestion, wasteful allocations of fish, and overfishing. We use survey data from anglers taking trips on for-hire vessels in the US Gulf of Mexico to estimate the magnitude of economic benefits squandered by current management. We find a minimum of $139/y of benefits per angler could be realized under appropriate management reforms. These rights-based approaches would improve angler benefits by increasing flexibility to fish year round—improving access while establishing greater accountability for fish harvest. Extending similar reforms worldwide could generate billions of dollars of benefits to anglers and related sectors.

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Mexico (GOM) to estimate the monetized loss of angler welfare, as measured by anglers' willingness to pay for an alternative form of management, relative to status-quo management approaches that have fostered a "race for fish" during a short summer season. Our estimates for this archetypal fishery reveal the substantial costs to anglers of current management. We also demonstrate how feasible extensions of rights-based management approaches to the recreational context can both enhance angler welfare and protect fish stocks.

While GOM anglers pursue many species, reef fish, especially red snapper, are very popular. Red snapper is the most landed offshore species in the GOM and one of the top 10 recreationally landed species in the United States (31). Red snapper is in the midst of a 30-y rebuilding plan after decades of recreational and commercial overfishing. The commercial red snapper fishery has undergone rights-based management reforms that have enhanced the profitability of the fleet and allowed for year-round fishing under a well-enforced limit on total catch (32) (Fig. 1). Simultaneously, recreational anglers have experienced shorter open seasons and lowered bag limits as regulators have struggled to contain fishing effort in response to improving stock conditions (Fig. 1). The recreational season for GOM red snapper reached a low of 9 d in 2014 (33) despite increasing annual catch limits. This trend has fostered distrust of fishery managers and exacerbated allocation conflicts between recreational anglers and commercial fishermen (29).

To assess the effects of current management on angler welfare and the potential benefits of reform, we use an online survey of anglers' fishing preferences and behaviors. The survey respondents were 2014–2015 customers of a subsample of GOM for-hire headboats known as the Gulf Headboat Collaborative. The GOM for-hire sector includes over 1,300 vessels with permits to fish for reef fish in federal waters. The sector includes a large charter boat component and ∼70 relatively large headboats (or party boats) that mostly charge per customer (34). For-hire vessels are the primary means of offshore fishing for anglers without a private vessel, yet the for-hire fleet has been particularly harmed by shrinking seasons and bag limits as well as competition for the limited recreational fish allocation from private anglers. For-hire permits across the GOM have declined by nearly 20% (33). In response, the Collaborative urged regulators to explore an alternative rights-based management approach as an experimental pilot study. The program exempted participating vessels from federal recreational season closures while allowing potential year-round fishing subject to quota availability and enhanced reporting and monitoring requirements. The Collaborative received annual allocations of red snapper and gag grouper based on participating vessels' 2011 landings (35). Quota was then internally allocated to individual Collaborative vessels, with transfers allowed only within the Collaborative. The pilot began in January 2014 with 17 vessels owned by 13 businesses and concluded in December 2015 with 19 vessels and 15 businesses. These vessels were distributed across Alabama, Florida, and Texas and made up ∼25% of federally permitted headboats in the GOM (36).

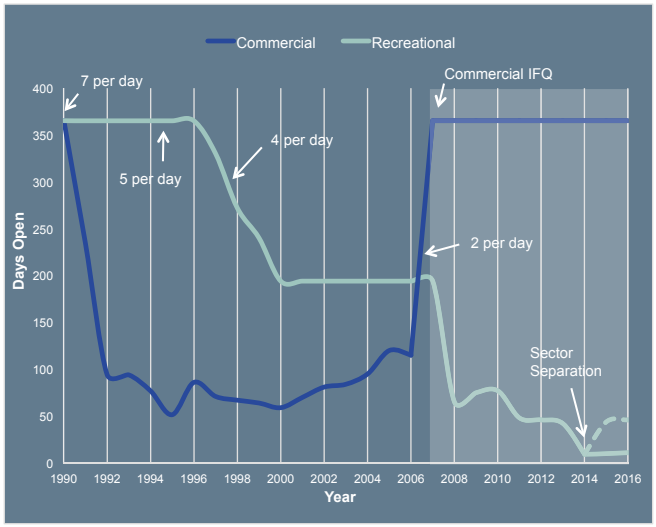

Fig. 1. Management history of the recreational and commercial Gulf of Mexico red snapper fishery. The light gray area represents the change to individual fishing quotas (IFQ) management in the commercial fishery. The recreational bag limits over time are indicated by the numbers per day. The dashed line for recreational fishing after 2014 represents the season for the for-hire sector.

The online survey gathered information on the number, timing, and characteristics of headboat trips taken by individuals. After reporting their fishing behavior, respondents were asked to report their anticipated behavior in an identical format under two alternative management scenarios. The first one (policy A) was designed to reflect a "status quo" fishing season (i.e., June for red snapper) and two-fish bag limit but with variation in the trip fee. Respondents were then presented a second scenario (policy B) that allowed year-round fishing for the target species but experimentally varied trip fees and bag limits. After respondents provided their likely behavior under each scenario they were asked to select which of the two policies they preferred.

We use these data to estimate a model of each angler's decisions of how many trips to take across four seasons per year, conditional on the fees, bag limits, and open seasons for red snapper (37–39). Using survey data on anglers' income, out-of-pocket travel costs, and the value they place on their travel time, we estimate their preferences for headboat trips as a function of trip characteristics and sociodemographic correlates of preferences. We then estimate anglers' expected trip demand and maximum willingness to pay (WTP) to secure changes to management variables (i.e., fees, bag limits, June vs. full-season red snapper retention). Our estimates of the economic value of management reform to headboat customers are grounded in respondents' considered behavior under alternative conditions. This approach has the benefit of encouraging respondents to consider how they would adjust their decisions and allows us to compare trips in policy A to actual trip behavior.

Simply creating a year-round season for red snapper fishing will result in overfishing relative to the status-quo scenario, and some combination of increases in fees and reductions in landings per customer is needed to allocate scarce fish. It is challenging to predict the combination of mechanisms vessel owners may use under rights-based reforms. Owners are likely to maximize the value of their secure quota allocations by offering a customized range of spatially and seasonally differentiated trip offerings. During the policy experiment, companies offered trips retaining red snapper year-round. They often limited customers to one red snapper, and captains managed catch rates to limit landings and regulatory discards. A few vessels also charged a small premium for red snapper trips (36). We simulate two alternative reform scenarios. In the first one, we allow year-round retention of red snapper and maintain the two-fish bag limit but raise headboat trip fees until the expected landings are the same as the status-quo scenario. Under the second scenario, we roughly approximate the outcome under the policy experiment by reducing the bag limit to one fish for all trip types and seasons and raising trip fees to achieve the expected status-quo landings. We predict expected landings under our scenarios by combining the spatiotemporal predictions of trip demand with 2014–2015 data on region- and season-specific angler landings rates for Collaborative vessels. This method provides an empirically grounded approach that incorporates, without

detailed modeling, the induced behavioral adjustments of vessels in terms of targeting and discard practices (*SI Appendix*, *Landings Predictions*). The resulting WTP estimates for the two scenarios provide an annualized measure of what the typical GOM headboat angler would be willing to pay for management reform that allows potential year-round fishing while respecting quota constraints—the recreational analog to increased fishery profits.

Results

After validating the policy A and policy B responses against the 2014/2015 trip recall data (*SI Appendix*, *Response Statistics and Data Summary*), we combine the data to estimate the recreational demand model. The parameter estimates suggest that characteristics of anglers play an important role in the number and timing of trips (*SI Appendix*, Table S6). Anglers with children in the household tend to fish less, while males and anglers that are part of an angler organization are more avid. GOM residents (those with homes in the region) fish less overall but favor full-day trips relative to nonresidents. On the whole, anglers prefer fishing in June and other summer months. However, this preference is heterogeneous. Anglers with children tend to favor summer fishing (perhaps due to complementarities with summer vacation activities) while GOM residents are less fond of June trips (perhaps due to heat and congestion).

We find that anglers strongly prefer retaining red snapper outside of the baseline June season under the status-quo two-fish bag limit. When the bag limit in non-June months is reduced to one fish, this preference remains significant but attenuates slightly. We find no evidence that policy B has any effect on demand for June trips; instead the policy increases demand for trips in formerly out of season months.

Fig. 2, *Top* shows the simulated effects on expected within-sample trips and landed red snapper of changes in headboat trip fees (holding constant other travel costs) and different bag limit scenarios under year-round retention. A 100% increase in the trip fee is expected to roughly halve the number of trips, while a fee increase of 30% moderates the increases in demand from year-round retention to baseline levels (vertical line in Fig. 2, *Left*). However, since year-round retention increases red snapper landings per trip, we increase trip fees in our simulation to achieve status-quo retention levels (40% for a one-fish bag limit or 100% for two fish).

We find that reducing the bag limit to one fish only mildly reduces the number of trips. However, the effects on predicted red snapper landings are substantial. The implications of alternative fee/bag limit policies for average welfare are mirrored in Fig. 2, *Bottom*. As with trips, the effects on welfare of reducing bag limits are relatively minor. However, since the two-fish bag limit scenario requires substantial increases in trip fees to match status-quo landings, restricting anglers to a maximum of one retained red snapper dominates on welfare grounds for a given total quota.

Allowing anglers to retain red snapper year-round increases non-June demand by 36%, provided that current retention limits and pricing are in place (Table 1). While the welfare gains of year-round fishing are considerable ($336 per angler), this policy results in overfishing of 115% relative to the baseline. If total allocations to vessels under a rights-based system were calibrated to achieve status-quo landings, then vessels must devise methods to allocate their scarce quota resources across trips and anglers. Table 1 and Fig. 2 show that the number of trips and, especially, welfare are quite sensitive to the adopted fee/bag limit strategy. If vessel owners maintained bag limits of two red snapper on all trips, then this would require a uniform fee increase of 100% to remain within their allocations. These large fee increases completely overwhelm the welfare gains from year-round access to red snapper—yielding welfare losses of $62 per angler.

By contrast, if all companies uniformly restricted customers to one red snapper per trip while increasing their fees by 40%, then predicted landings remain within the baseline allocation while increasing mean welfare by $139 per angler. The overall number of trips declines by 10% (mostly in June); however, this reduction in trips is more than compensated for by increased revenue per trip. Both anglers and for-hire service providers are made better off under this scenario. Red snapper landings are now spread much more smoothly across the season, with over 78% now caught outside of the June season. The policy also results in some

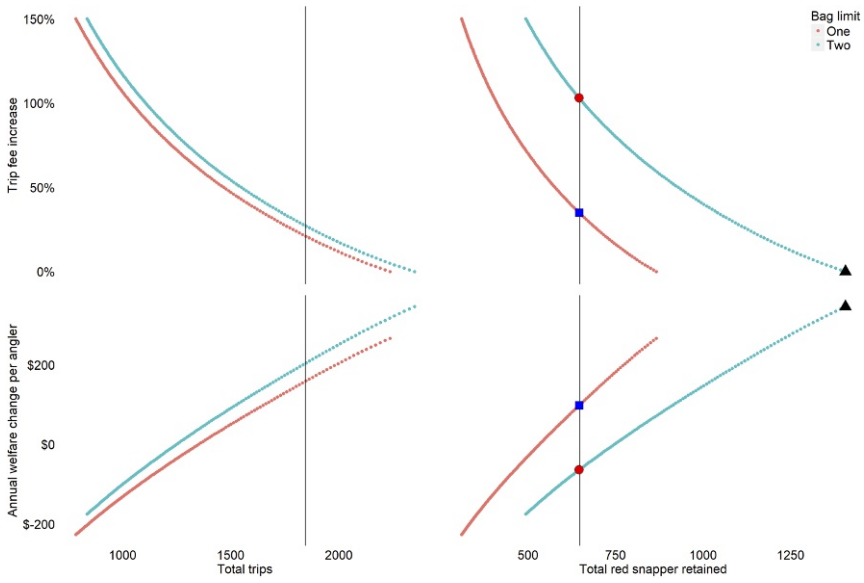

Fig. 2. Predicted effects on average trips and welfare of changes in trip fees and bag limits under year-round retention for red snapper. The vertical bars reflect predicted trips (*Left*) and red snapper landings (*Right*) under a status-quo June red snapper season, with a two-fish bag limit and no fee increase. Black triangle scenarios maintain status-quo fee and bag limits but allow for year-round red snapper retention. Red circles achieve status-quo landings using two-fish bag limits and a 100% fee increase. Blue-square scenarios achieve status-quo red snapper landings using a one-fish bag limit and a 40% fee increase.

Table 1. Expected trips, landings, and welfare

Overall trips			Overall red snapper landings			
June	Non-June	Total	June	Non-June	Total	Mean welfare
Baseline (June-only retention)						
489	1,356	1,845	649	0	649	—
Two-fish bag limit with 0% trip fee increase, year-round fishing						
488	1,844	2,332	315	1,082	1,396	$336
(0.4)	(182.8)	(182.7)	(0.3)	(108.3)	(108.2)	($131)
One-fish bag limit with 40% trip fee increase, year-round fishing						
345	1,312	1,656	142	508	650	$139
(2.7)	(138.3)	(138.5)	(1.1)	(53.5)	(53.5)	($116)
Two-fish bag limit with 100% trip fee increase, year-round fishing						
219	879	1,098	139	514	653	-$62
(3.8)	(106.2)	(106.7)	(2.6)	(63.7)	(64.1)	($97)

Cluster bootstrap SEs are in parentheses, using 500 conditional error draws. The overall trips and red snapper landings numbers are for all 537 red snapper anglers in the sample. Mean welfare changes are per angler per year.

redistribution of fishing across the year; 20% of overall trips occur in June as opposed to 26% under the baseline scenario.

Of course, not all anglers value the policy change equally. Fig. 3 compares average welfare across different strata of the population for the one-bag limit/40% fee increase scenario. We find that WTP increases strongly for individuals over the age of 60, perhaps due to the ability and willingness of these individuals to increase their trips in nonsummer months in response to the availability of red snapper. The WTP for management reform is highest for individuals with intermediate household income, while the WTP for high-income individuals is only slightly more than for those with household incomes below $75,000. Not surprisingly, avid anglers, those reporting three or more trips in the past, accrue far greater benefits than do more sporadic anglers. We also find a significant regional pattern in the distribution of benefits from reform. Given our assumptions, the mean WTP of GOM residents is actually slightly (but insignificantly) negative at −$7 per angler while the largest average benefits accrue to regular visitors. However, the average benefits for these strata are imprecisely estimated due to the fact that any single variable explains relatively little of the within-sample variance in welfare effects (R^2 varies from 0.01 to 0.04). Indeed, much of the variability in estimated welfare across anglers cannot be explained by observable demographics.

As a final validation of the survey data and welfare results we estimate a conditional logit model on the policy referendum question. We find the strongest support for policy B among higher-income anglers, those with a second home in the region, and those with broader fish-targeting interests (*SI Appendix*, Table S9). Most importantly, we find that both changes in reported trips across the scenarios and the expected individual welfare under policy B relative to policy A are strongly predictive of individuals' directly elicited policy preferences (*SI Appendix*, Table S9). This provides an indirect source of validation of our data and modeling approach.

Discussion

The management of many saltwater recreational fisheries is rooted in the "public trust" doctrine—enshrining open access to publicly managed fisheries as a de facto right. Despite its egalitarian appeal, open access fails to ensure that the demand placed on the fish stock by anglers remains within the available (regulated) supply, with the result that anglers secure their rights at the expense of future generations. To resolve these contradictory demands, managers have often allocated harvest by first possession combined with closed seasons and possession limits. While potentially capable of achieving a biologically sustainable fishery, these regulations can produce many inefficiencies by homogenizing the terms of access to the fish stock across an inherently heterogeneous angler population. Some anglers may highly value fishing for their preferred species during cooler or less crowded seasons or when recreation is less costly given individual work and family constraints. Others may highly value landing fish in excess of the bag limit, while others would gladly retain fewer fish or even fish in a purely catch-and-release manner. The result is that season and bag limits may allocate fish in a manner that bears little relation to its highest value to anglers. As anglers adapt their trip behavior to operate within the regulated season, the resulting concentration of effort may lead to congestion effects that reduce the enjoyability of the experience. Anglers, or the for-hire industry that serves them, may also invest additional resources to ensure they maximize their catch on the trips they do take—investing in faster boats and more efficient tackle than justified under less competitive conditions (27). Each of these behavioral adaptations may erode the potential contributions of the available surplus fish stock to angler welfare.

When the catch of a species is highly valued and has few substitutes, a recreational "race to fish" similar to that observed in many commercial fisheries can result. If demand for fishing trips increases strongly in catch rates, a paradoxical situation may emerge where regulations must tighten dramatically even as stocks grow and overall quotas increase. The political difficulties of implementing these draconian policies may result in half-measures that hedge between conflicting goals of stock management and season stability, potentially jeopardizing sustainable management.

Our estimates from the GOM suggest that substantial benefits to anglers are left "on the table" under policies that dominate the management of most recreational fisheries. We estimate that forsaking temporal rationing of red snapper in favor of an approach

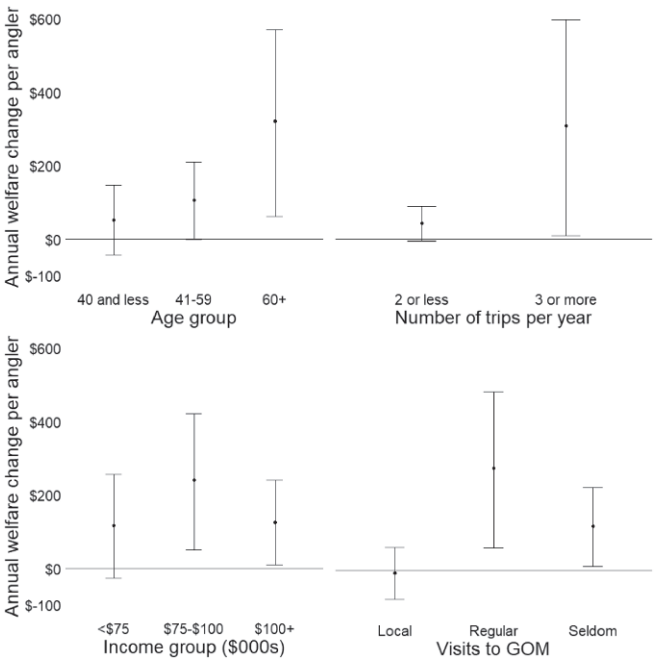

Fig. 3. Mean welfare measures by distributional stratum for year-round fishing under the one-fish bag limit, 40% fee increase scenario (relative to the baseline scenario). Each mean welfare measure is produced using sampling weights that are renormalized to sum to one within each stratum. The whiskers represent 95% normal confidence intervals based on the bootstrap SE (*SI Appendix, Trip Prediction and Welfare Analysis*).

that allows headboat vessels to use their own secure annual allocations of quota to provide year-round retention to their customers would increase overall welfare of GOM headboat anglers by $12.3 million/y (*Materials and Methods*). Evidence from the pilot program showed that rights-based management allowed Collaborative participants to increase the number of trips retaining red snapper by 161%, despite much smaller increases in quota allocations (36). This provided a year-round red snapper fishery, with one-third of trips occurring before the June season. Collaborative business used a differentiated set of strategies to extend their allocations. Many operations limited customers to one red snapper per trip, particularly on half-day trips. Headboat owners reported no notable customer dissatisfaction or decreases in demand—validating our finding of fairly minimal welfare effects of bag limit reductions. Vessels also reduced their red snapper catch rates while maintaining landings per customer across a portfolio of species—a strategy that reduced red snapper discard rates by over 40% (36). Altogether, the Collaborative experiment provided operators with the flexibility to innovate and differentiate their product offerings to increase their profits by expanding customer access to valuable red snapper trips (36).

Given the multiple tactics of Collaborative vessels to convert their allocations to valuable fishing trips for their customers, it is likely that our estimate of welfare gains from management reform understates the net benefits of a permanent program modeled after the pilot. The design of the policy B scenarios does not allow us to explore demand responses and welfare impacts under scenarios where fees and retention limits are allowed to vary by region, season, trip length, or day of week or across trips offered by a given company. As the policy experiment demonstrates, such differentiated strategies are an expected outcome of a rights-based approach to management, as business owners seek ways to maximize the value of their quota by creating valuable, quality-differentiated services for their customers. Such product differentiation can benefit both for-hire companies and customers as long as there is sufficient competition in regional markets to limit individual firms' "market power."

While rights-based management approaches such as IFQ and cooperatives have great potential for aligning economic incentives with conservation (40), extending these approaches beyond the for-hire sector to encompass anglers fishing from their own vessels faces significant practical and political challenges. Nonetheless, pragmatic rights-based management approaches are capable of achieving many of the same economic benefits while improving accountability (29, 41). These include the use of attenuated, limited-duration rights to harvest, such as fish harvest tags (30) or rights-based instruments to inputs of fishing, such as fishing days. These approaches could be implemented in a convenient manner using smart-phone technology and combined with incentives for providing personal data on trip landings and discards. While maximization of net benefits to anglers would be facilitated by fee-based allocation and free resale of tags, concerns for fairness could be accommodated through lottery-based means of allocation or possession limits on individual tags (30).

Given insufficient data on trip demand for most recreational fisheries and the hidden nature of anglers' welfare losses, it is exceedingly difficult to provide a reliable estimate of the potential benefits from rights-based reform of recreational fisheries to compare with estimates for their commercial counterparts (3). Simply extrapolating the mean estimate of $139 per angler to the estimated 220 million anglers (both freshwater and saltwater) in the world yields an annualized value of over $30 billion (13), or approximately $13 billion if limited to anglers in Organization for Economic Cooperation and Development (OECD) countries, or $1.2 billion if limited to the estimated 8.9 million US saltwater anglers (42). These "ballpark" estimates are undoubtedly crude and may be upward biased as they use a value of reform from a relatively affluent population of anglers in a particularly inefficient fishery. However, there are counterarguments against this alleged bias. First, our estimates reflect the welfare gains to participating anglers of reforming one fishery. However, some anglers participate in multiple recreational fisheries and may be willing to pay significantly more than $139/y for reform of all of the fisheries in which they participate. Second, our analysis relies upon active anglers in 2014/2015. It does not capture the potential of reform to induce previously inactive anglers to participate in response to improved availability of preferred species outside of congested, short seasons. Finally, our valuation approach considers only the short-run effects of reform in that all policies reallocate a fixed stock of fish. If policy changes caused or facilitated recovery for overfished stocks, then we would expect long-run welfare gains to exceed our short-run estimates. Finally, our estimates do not include any potential economic gains to for-hire operators (27), bait and tackle purveyors, or the broader tourism sector.

Regardless of exact magnitudes, our analysis shows that the status-quo policies used in most recreational fisheries may fall well short of maximizing the net benefits of anglers. Appropriate reforms will depend heavily upon the local context and governance capacity, and managers may have important social equity goals to address aside from economic efficiency. Nevertheless, it is time to recognize that the "sunken billions" (43) attributed to management failures in commercial fisheries may exist in many recreational fisheries as well.

Materials and Methods

We administered a survey of headboat anglers using a two-stage process. In the first stage we recruited anglers to our sample using an onboard survey of Collaborative customers that gathered socio-demographic data and participants' email addresses. We used these emails in the second stage to recruit anglers to an online survey deployed in 2015 and 2016 waves. The survey collected information on the number of partial and full-day headboat trips the respondent took in the previous year during winter/spring (January–May), June, summer (July and August), and fall (September–December) seasons. The seasons were defined to reflect the seasonality of the fishery and to reflect that June has contained most of the open season for red snapper in recent (pre-2014) years. These recall questions were followed by the policy A/B contingent behavior questions, with some respondents receiving scenarios framed around red snapper and others those for gag grouper (*SI Appendix, Survey Design*). To account for issues of sampling, stratification, and self-selection in our sample, we implement a three-stage strategy to create spatial–temporal poststratification survey weights that are used in model estimation and simulation (*SI Appendix, Demand Model Estimation*).

For each angler, we calculate seasonally varying expected travel costs as the sum of monetary and time costs of traveling to the GOM and headboat trip fees (*SI Appendix, Travel Cost Calculation*). The contingent behavior trip data, season-specific travel costs, and angler characteristics are used to estimate the seasonal Kuhn–Tucker (KT) trip demand model using a translated generalized constant elasticity of substitution (tCES) utility function (*SI Appendix, Trip Demand Model Specification*) (38). For each red snapper angler, the KT model parameters are used to simulate trip behavior and calculate welfare impacts of moving toward a year-round red snapper fishing policy regime with varying fish bag limits and trip fees. We convert estimated trips to expected red snapper landings using region, season, and trip length-specific logbook data from Collaborative participants (*SI Appendix, Landings Predictions*). Total GOM headboat welfare is calculated by multiplying the mean angler welfare by the estimated total number of unique headboat anglers using National Marine Fisheries Service Southeast Region Headboat Survey data (*SI Appendix, Total Welfare Measures*).

Responses to the policy referendum question are analyzed using a conditional logit model. Observed heterogeneity is included in the model by interacting a policy B indicator with angler characteristics and angler trip and welfare changes between policy A and policy B.

The survey data were gathered under University of Alberta IRB agreement MS1_Pro00060074, and informed consent was secured for both the in-person and Internet surveys. Our IRB agreement prevents distribution of personally identifiable information, including variables directly included in the KT model. Nonconfidential subsets of the data are available from the authors upon request. The final model code is posted on Github (https://github.com/plloydsmith).

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