Perceptions outweigh knowledge in predicting support for management strategies in the recreational Striped Bass (*Morone saxatilis*) fishery

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Abstract

Considering that recreational fisheries represent tightly bound social-ecological systems, the development of effective and holistic policy should involve the consideration of stakeholder interests and behaviors. Yet, integrating stakeholders' input in fisheries management requires understanding and representing their different values, knowledge systems, and beliefs. Using survey data from recreational Striped Bass (*Morone saxatilis*) anglers in Massachusetts, this study examined relationships among angler knowledge and perceptions, fishing characteristics, and support for various fishery management measures (e.g., slot limit, reduced bag limits). Results revealed that most anglers underestimated the age at which female Striped Bass reach sexual maturity and the age at which Striped Bass grow to 40" in length. Estimated ages for both metrics increased with fishing experience, but estimates were not influenced by other angler characteristics. Importantly, while participants' knowledge of Striped Bass age at maturity (i.e., proximity to actual age at maturity according to literature) was not correlated with support for policies, their perceptions of Striped Bass age at maturity (i.e., participants' unadjusted estimates of age at maturity) were a consistent predictor of policy support. Specifically, perceptions of Striped Bass age at maturity was positively correlated with policy support (i.e., there was higher support for policies among those that believe that Striped Bass mature at older ages). Given that a large majority of anglers underestimate Striped Bass age at maturity, initiatives to communicate Striped Bass biology to the angling public could further enhance support.

Collectively, these findings illustrate how stakeholder perceptions can favorably shape angler support for fisheries management policies.

Keywords: social-ecological systems, Striped Bass, recreational fishery, angler knowledge, angler perceptions

Highlights

- Most recreational anglers underestimate the typical age at which Striped Bass reach maturity and grow to 40” in total length.
- Recreational fishing experience is an important predictor of angler perceptions of fish biology.
- Knowledge does not directly correlate with recreational angler support for more restrictive management measures. Instead, anglers’ perceptions of fish growth and reproduction predict supportiveness.
- Anglers who believe Striped Bass mature at older ages are more supportive of more stringent regulations.

1. Introduction

1.1 Social-ecological systems and angler behavior

Understanding the knowledge and perceptions of fishery participants along with their fishing behaviors, will facilitate inclusive fisheries management and aid in the development of more sustainable policies [1-3]. Incorporating this information is especially critical when recreational fisheries are composed of diverse stakeholder groups, as is often the case [4]. For example, multiple social norms may exist within a single fishery that can influence divergent fishing behaviors, such as tendencies to catch-and-release versus catch-and-keep [5]. Anglers can also hold unique motivations for fishing and perspectives on appropriate management strategies,

which consequently may influence how they respond to and their willingness to comply with specific policy measures [4, 6-8]. Moreover, consideration of the factors that correlate with angler perspectives, behavior, and support for management will allow managers to structure policy more effectively.

A myriad of factors, such as fishing commitment and skill, can influence angler perspectives and behavior, and these characteristics often correlate with support for conservation and management initiatives [9, 10]. Additionally, recreation specialization can influence behavior such as the degree to which anglers are attached to specific fishing sites [10]. Considered a sub-dimension of the broader concept known as recreation specialization, behavioral commitment can be measured as the number of times an individual goes fishing in a given year and the number of fish they catch [9-11]. Similarly, fishing experience, as indicated by the years an angler has participated in a particular fishery, often correlates with attitudes and opinions on fisheries policy [12, 13]. For example, highly experienced participants in a New Zealand recreational Blue Cod fishery were more highly dissatisfied with current regulations [12]. Stakeholder views of natural resource systems and the interacting components of those systems are also potentially influenced by the individual's social setting, and are grounded in the individual's knowledge base [14]. While behavior can be difficult to change through education alone, pro-environmental behaviors may be enhanced by different types of environmental knowledge [15]. Therefore, understanding of the knowledge and perceptions held by fishery stakeholders is an appropriate first step towards revealing factors that contribute to their behavior and relative support for more effective management policies [16, 17].

1.2 Striped Bass recreational fishery

This study used the Striped Bass (*Morone saxatilis*) recreational fishery in Massachusetts as a model system to explore which factors potentially contribute to stakeholder views on regulatory action. The Striped Bass recreational fishery was chosen due to its prominence in New England's fishing culture, particularly in Massachusetts where annual fishing trips are estimated at over 1.1 million (Personal communication from the National Marine Fisheries Service, Fisheries Statistics Division October 13, 2016). As Striped Bass annually migrate through New England, they offer ample fishing opportunities for both boat and shore-bound anglers [18]. Additionally, this recreational fishery contributes substantially to the Massachusetts' coastal economy and dominates the annual harvest of Striped Bass relative to the commercial sector in Massachusetts [19, 20].

Striped Bass have been harvested for centuries in the western Atlantic, but suffered severe population declines in the late 1970's and early 1980's [21, 22]. Due in large part to an aggressive management plan, Striped Bass completely recovered, and consequently are considered a significant fishery success story [23]. However, more recent declines in spawning stock biomass have led to the implementation of several policy measures aimed at reversing this trend, including a reduction in the daily bag limit in Massachusetts [24]. These management decisions for Striped Bass in the north Atlantic are regionally guided by the Atlantic States Marine Fisheries Commission (ASMFC), which utilizes common biological reference points, such as spawning stock biomass and fishing mortality. The ASMFC also engages stakeholders in the management process through an advisory panel composed of fishers from the recreational and commercial sectors. While this process provides an important voice for stakeholders, only a small percentage of anglers attend these meetings, leaving gaps in our understanding of the needs and perspectives of the entire recreational fishery.

Within the Striped Bass fishery, recreational anglers are less supportive of traditional output control measures, such as a reduced recreational daily bag limit [13]. They instead prefer typical input control and qualitative output control measures, like minimum and maximum size limits, rather than quantitative output control measures such as reduced daily bag limits [13]. In fisheries management, input controls are used to regulate fishing effort, gear, or vessel capacity and thus indirectly affect fishing mortality [25]. For example, the required use of circle hooks is an input policy and is thought to potentially reduce fish release mortality [26]. Conversely, output controls directly limit the number of fish being harvested, and consequently are thought to be more effective in directly controlling catch and avoiding overfishing [27]. Reduced angler support for these types of output controls is not necessarily surprising, but illustrates a principle challenge and potential tradeoff in fisheries management: the development of policy measures that have the ability to effectively reduce fishing effort and mortality as well as are supported and obeyed by fishery participants. Therefore, this study aims to enhance our understanding of angler knowledge of fish biology and perceptions to examine how they relate to support for management measures. Note, that throughout this study the term ‘angler’ is used to refer to recreational hook and line fishers. Using an online survey of recreational anglers, this study (1) assessed the biological knowledge and perceptions of recreational anglers, (2) examined correlations between knowledge, perceptions, and support for policy change, (3) evaluated potential relationships between types of recreational anglers and support for policy change, and (4) explored the underlying characteristics of anglers that correlate with their perceptions. Collectively, this information is aimed at advancing our understanding of the factors that will result in broad support throughout the recreational fishing industry for effective policy measures aimed at enhancing the sustainability of the Striped Bass fishery.

2. Methods

2.1 Survey implementation

Licensed anglers from the 2013 fishing season were contacted using an email list provided by the Massachusetts Division of Marine Fisheries and the Connecticut Marine Fisheries Division. Since this study was focused on understanding the perspectives of individuals that fished in Massachusetts, for the analyses, we included individuals that selected they fish in Massachusetts (i.e., they could have selected Massachusetts only, or Massachusetts and Connecticut). The database was composed of approximately 155,000 recreational, saltwater anglers, from Massachusetts and another 35,000 from Connecticut (license required for anyone 16 years of age or older). Emails were sent to a random subsample of 2,000 individuals from each state (4,000 total). Following a modified Dillman method, reminder emails were sent and raffled gift cards were offered to increase participation rates [28]. The survey was conducted using Qualtrics Survey Software Research Suite and was open from February 7th to March 7th, 2014. Participants were excluded from the survey if they selected that they do not fish for Striped Bass. The survey was approved by Northeastern University's Institutional Review Board (Project #13-11-25).

2.2 Surveying knowledge and perceptions of Striped Bass biology

To assess the anglers' knowledge and perceptions of Striped Bass biology, participants were queried on questions related to Striped Bass maturation and growth. Knowledge questions were chosen because growth and maturation rates may help guide fisheries policy and are important for fisheries stock assessments [29]. Participants were asked to report the ages at which (1) female Striped Bass reach sexual maturity (only a small percentage of males migrate into Massachusetts) and (2) Striped Bass reach 40" in total length. 50% of female fish are

predicted to reach maturity on average by age 5.3, and attain 40” in length typically by age 12 [30, 31]. Data from Mansueti [31] were reported in fork lengths, so the conversion of a 40” (total length) fish was completed using Striped Bass collected in northern Massachusetts from a separate diet analysis study ($R^2 = 0.98$ for linear regression of total length by fork length, *author unpublished data*). Responses to these questions were examined in two ways: (1) using the absolute difference between the responses and the literature estimates (i.e., response accuracy) and (2) using the raw responses (i.e., responses were not adjusted to reflect how close they were to the actual age). The former of these metrics reflects the participant’s knowledge about Striped Bass, since it reflects the correctness of their answer, while the latter is a measure of their perception. For example, if a respondent answered that female fish are mature at age 7, they would be given a *knowledge* score of 1.7 and raw, or *perceived*, score of 7.

2.3 Examining fishing characteristics

A number of angler classification questions were utilized to examine factors that may contribute to support for policy (Table 1).

Table 1 here

Broadly, the survey was used to assess angler experience, recent commitment, Striped Bass specialization (i.e., percentage of fishing effort targeted at Striped Bass), and how much they fish from shore versus a boat. Participants were queried on the number of Striped Bass they harvested and released in a number of size categories (under 28”, 28” – 40”, and over 40”) and these values were summed for each participant to represent the total number of Striped Bass caught in the previous fishing season. Experience was approximated using the number of years anglers have been fishing for Striped Bass, while the number of days an angler fished in the previous season and the number of Striped Bass caught were collectively used as proxies for recent commitment.

161 *2.4 Assessing regulation receptiveness*

162 Participant supportiveness towards three potential policy changes was assessed using
163 Likert-scale questions from “strongly support” to “strongly oppose”, with “neutral” as the middle
164 response for participants that neither supported nor opposed the proposed policy change.
165 Recreational fishery participants were queried on one input control measure, a circle hook
166 mandate (i.e., requiring the use of circle hooks), and two output control measures, a reduced
167 daily bag limit (from two down to one fish allowed to be harvested per day) and implementation
168 of a slot limit (hypothetical minimum and maximum size limit). The proposed reduced daily bag
169 limit is a more quantitative output policy because it directly regulates the number of fish leaving
170 the fishery. On the other hand, the slot limit is a qualitative output policy and, as such, offers
171 fisheries managers an indirect route to limiting harvest. To note, at the time of the survey, state
172 fishing regulations limited recreational anglers to two fish per day with a minimum size of 28”
173 total length. The regulation changes that we proposed in the survey were selected based upon
174 previous communication with local recreational anglers and because they have been used within
175 other recreational fisheries [32-34]. Neutral responses were excluded from the analyses of policy
176 receptiveness (proportion neutral; Slot limit = 17%, Circle Hooks = 30%, Bag Limit = 13%), and
177 all other responses were converted to binary categories of *supported* or *opposed* (e.g., responses
178 for “strongly opposed” and “slightly opposed” were grouped together) to distinguish between
179 anglers with directly contrasting viewpoints as to gauge support for versus against each proposed
180 policy measure [35].

181 *2.5 Statistical analyses*

182 To compare the knowledge and perceptions of anglers that *supported* versus *opposed* the
183 proposed regulation changes, Kruskal-Wallis tests were used to assess differences between each
184 group’s mean knowledge and perception scores. Results clearly indicated that support for all

three regulations tracked positively with raw responses (i.e., participant perceptions) but not their knowledge, so the remainder of the analyses examine raw scores only. Logistic regression was utilized to evaluate the potential influence of perceptions and angler characteristics on policy support. Specifically, we tested the effects of all perception variables and angler classification variables as independent predictors of angler support towards each regulation (binary response of either *supported* or *opposed*). Note, that a few extreme knowledge responses were excluded from analyses (i.e., years to age at maturity ≥ 15 (n=4), years to 40" TL ≥ 24 (n=2)) and the factor, *Total Striped Bass caught in 2013*, was truncated at 100 fish and *Days fishing in 2013* was truncated at 60 days as to eliminate the potentially large influence of a few outlier responses, resulting in more conservative estimates of the relationships between fishing characteristics, knowledge, and policy support. The relationships between angler classification variables and perceptions were assessed using regression tree analysis and Spearman's rank correlation tests. Results for all tests were considered statistically significant at $p < 0.05$.

3. Results

3.1. Participation and demographics

From the 4,000 emailed invitations, the survey received a total of 731 participants for a 18% response rate. Since this study was focused on the perspectives of anglers from a single state's fishery (i.e., to remove any geographic variation), 180 anglers were removed that exclusively fished in Connecticut, but included 66 anglers that selected they fished in both Massachusetts and Connecticut. Roughly 96% of participants were male and the median year of birth was 1960. The plurality (31%) of participants selected that they had completed a four-year college degree as their highest level of education, while the plurality (26%) of participants'

annual income ranged between $100,001 to $150,000. The average angler had been fishing for Striped Bass for 23 years and fished an average of 16 days in the previous fishing season.

3.2. Knowledge

Overall responses from survey participants revealed that anglers generally underestimated fish maturity and growth (Table 2a), with the vast majority of participants underestimating the age at which female Striped Bass reach sexual maturity (85%) (Figure 1a) and 40" in length (78%) (Figure 1b).

Figure 1 here

Table 2 here

3.3. Factors that explain support for regulations

Recreational Striped Bass anglers that *supported* the proposed regulations generally perceived that female Striped Bass mature later, as compared to individuals that *opposed* these regulations (Kruskal-Wallis tests: slot limit: $p = 0.004$, reduced bag limit: $p = 0.014$, circle hook mandate: $p = 0.042$, Table 2b). Importantly, however, knowledge of respondents' age estimates (i.e., response accuracy) did not correlate with support for any of the regulations (slot limit: $p = 0.441$, reduced bag limit: $p = 0.116$, circle hook mandate: $p = 0.499$). Meanwhile, there was a significant positive correlation between their perceptions of Striped Bass age at 40" (i.e., uncorrected scores) and support for a circle hook mandate ($p = 0.031$), but not for a slot limit ($p = 0.205$) or a reduced bag limit ($p = 0.208$). Knowledge again did not track with angler receptiveness to any of the proposed regulations (slot limit: $p = 0.371$, reduced bag limit: $p = 0.299$, circle hook mandate: $p = 0.646$).

228 Logistic regression analysis was used to compare how different fishing characteristics
229 (e.g., years fishing, number of Striped Bass caught), along with perceptions, potentially correlate
230 with support for policy. Support for a slot limit was only positively correlated with angler
231 estimates of fish age at maturity ($p = 0.001$), whereas support for a reduced bag limit and circle
232 hook mandate were correlated with a number of variables (Table 2c). Support for a reduced
233 daily bag limit increased with respondents' estimates of age at maturity, fishing effort allocated
234 to Striped Bass, and fishing effort from shore ($p = 0.03$, $p = 0.03$, and $p = 0.01$, respectively).
235 While support for a circle hook mandate similarly increased with respondents' estimates of age
236 at maturity, support tended to also increase with estimates of age at 40" and to diminish as
237 respondents fished more days in the previous fishing season ($p = 0.03$, $p = 0.009$, and $p = 0.03$,
238 respectively).

239 *3.4. Factors that explain perceptions*

240 Next, the relationships between angler perceptions of Striped Bass age parameters and
241 angler experience, commitment (number of days fished and number of fish caught), fishing effort
242 from shore, and effort towards Striped Bass were assessed using regression tree analyses. There
243 appeared to be little influence of these variables on perceived age estimates, with the exception
244 of fishing experience (Figure 2).

245 **Figure 2 here**

246 There was a significant split at 13 years of fishing experience for estimates of the age at which
247 fish mature. For estimates of age at 40", there was a significant split at 18 years of fishing
248 experience. In both scenarios, anglers with more experience believed Striped Bass mature (<13
249 years experience: n = 107, mean = 3.2, ≥13 years experience: n = 255, mean = 3.9) and reach 40"
250 (<18 years experience: n = 149, mean = 7.5, ≥18 years experience: n = 216, mean = 8.8) at older

ages as compared to less experienced anglers. Spearman's rank correlation tests verified this finding and revealed that only fishing experience was significantly correlated with respondents' age estimates: age at maturity (Spearman's $\rho = 0.206$, $p < 0.001$) and age at 40" (Spearman's $\rho = 0.183$, $p < 0.001$). To note, however, there was a marginal, yet statistically non-significant, positive trend between the number of days spent fishing and age at maturity (Spearman's $\rho = 0.094$, $p = 0.07$) and age at 40" (Spearman's $\rho = 0.097$, $p = 0.061$).

4. Discussion

This study found that angling populations underestimate Striped Bass age at maturity and the age at which Striped Bass reach 40" in length. In addition, perceptions, particularly angler perceptions of Striped Bass age at maturity, are consistent predictors of support for management measures aimed to promote a sustainable fishery. Yet, the degree to which anglers know the exact age of maturity is less critical than the perception that Striped Bass require several years to mature. In the recreational Striped Bass fishery, anglers may be more inclined to support strategies that protect large females if they understand that female fish require many years to reach maturity, or that large females contribute disproportionately to reproductive output. This is most apparent for the slot limit regulation, where there was a strong relationship between perception and support. As the perceived ages at maturity and 40" total length increased, there was also a clear rise in support for a reduced daily bag limit and a circle hook mandate, the latter of which would improve overall release mortality, though is likely a more indirect route to protecting large female fish.

These results indicate that different factors may have led to support for output and input controls. Support for the qualitative output control (i.e., a slot limit) was only correlated with perceptions of fish age at maturity, while multiple factors tracked with support for the

quantitative output control (i.e., a reduced daily bag limit). For the latter, participants that did not fish from shore often (i.e., they fished from a boat more frequently), who potentially allocate a higher financial investment into fishing, were less supportive. Support for the input control measure of a circle hook mandate was positively related to both metrics of perceptions (i.e., age at maturity and age at 40"), but tracked negatively with commitment, such that individuals who fished more frequently appeared less apt to change behavior. This finding is somewhat counter to previous work that generally purports that anglers that allocate more time to fishing are more likely to support increasingly restrictive regulations. For instance, Loomis et al. [36] found that individuals that fish more frequently (as part of a composite index of recreation specialization) supported numerous size limit regulations and tagging requirements for trophy fish. Alternatively, there is some evidence that anglers with more experience (indicated by years of experience) may be increasingly rigid in their fishing habits and less likely to support changes [12]. In our study system, highly committed anglers could be less receptive to changing fishing gear, possibly because they are more confident in their current methodology, or they may believe that circle hooks would not be adequately effective at promoting the sustainability of the Striped Bass fishery. It is also possible that some anglers may be unfamiliar with how to use circle hooks versus traditional treble or J-style hooks (i.e., differences in hook-setting techniques) [37]. Future research should seek to identify why some anglers are less receptive to the usage of circle hooks.

Social norms within separate fisheries or within recreational fishing subgroups may ultimately drive perceptions and thus support [38]. The different motivations held by anglers that use alternative fishing modes are also likely important [4]. Counterintuitively, anglers that primarily target Striped Bass appear to be more willing to reduce their daily harvest. This finding is consistent with Oh and Ditton [39], which revealed that more highly specialized

297 anglers (as classified using multiple variables to create an index of recreation specialization) in
298 Texas prefer current management measures as compared to the implementation of relatively less
299 restrictive policies, such as an increase in the daily bag limit or the relaxing of size limits of
300 harvestable fish. A potential explanation of this result could be that these anglers harbor
301 alternative motivations for fishing and are thus less consumptively oriented. For example, some
302 anglers may maintain activity general preferences, such as fishing for relaxation, versus activity
303 specific preferences, such as fishing for trophy fish [40], such that a decrease in the daily bag
304 limit would not affect their satisfaction with any given fishing trip. On the other hand, anglers
305 that focus more directly on Striped Bass may be more able to detect declines in catch rates
306 indicative of population declines, and therefore be more willing to support management
307 measures aimed at addressing this problem. Collectively, these results suggest that components
308 of recreation specialization may operate differently within and between output and input controls
309 measures. These findings illustrate the multi-dimensional nature of recreation specialization, and
310 that a diverse set of preferences may exist within a single fishery [11].

311 Fishing characteristics were examined independently from regulation support to
312 determine if and how perceptions naturally vary within fishing communities. Increases in
313 perceived Striped Bass age at maturity and age to 40” total length correlated with greater angler
314 experience, although anglers still underestimated Striped Bass growth and age at maturity, in
315 general. It is plausible that knowledge of fish biology may increase over time for anglers that
316 remain invested in Striped Bass fishing throughout the course of their life. This finding aligns
317 with previous work in the New Zealand Blue Cod fishery, where fishing experience was
318 positively related to knowledge of regulations [12]. Knowledge of fish maturation and growth
319 likely do not directly aid anglers in catching fish, but this type of knowledge may accrue as

anglers seek to learn more about Striped Bass to increase their fishing success. We speculate that the underestimation of fish maturity and growth potentially also results in under-appreciation of the vulnerability of a fish species to overfishing, as well as underestimation of the amount of time that will be required for the fish species to recover.

Figure 3 here

Collective examination of angler traits, perceptions, and policy support revealed distinct disconnects among fishing experience and support (Figure 3). Knowledge of fishing regulations have been shown to accrue with experience [12], but here we have also demonstrated that angler experience may led to increases in the perceived age at which Striped Bass reach maturity and 40". However, experience did not directly correlate with support for any of the policies examined. Instead, perceptions positively related to support of all regulations and thus deserves further examination. Angler support of a slot limit provided the strongest link between perceptions and resource management, where support was only predicted by perceptions of fish maturity. Meanwhile, support for a circle hook mandate and a reduced daily bag limit are collectively guided by three angler classification variables – specialization on Striped Bass, the degree to which anglers fish from shore versus a boat, and the number of days people fish – but these same variables do not track with perceptions. This finding suggests that angler support for management measures can be driven by multiple factors, including their perceptions of the species they harvest, as well as social norms that exist within the fishery.

While there are likely aspects of the recreational Striped Bass fishery that are similar to other fisheries across the United States, findings herein must be applied carefully to other regions and/or fisheries. For one, the low diversity of recreational fishes in the Gulf of Maine, specifically those that can be targeted from shore, may influence the views of anglers and reduce

their willingness to change behavior. As an example, eel anglers in northern Germany appear to display inelastic behavior in response to regulation changes possibly due to few alternative fishing opportunities [41]. It is plausible that anglers in coastal areas with higher fish diversity are apt to respond more favorably to management measures if they have ample alternative species to target (i.e., reduced specialization is occurring for an individual species).

5. Conclusions

Recreational anglers comprise an integral component of social-ecological fishery systems. Therefore, a better understanding of the dynamics of stakeholder groups and the underlying characteristics that lead to decision making and behavior would facilitate efforts to manage these fisheries [42, 43]. Examination of recreational fisheries is increasingly warranted, given that they make up a sizeable portion of total catch in the United States; in Massachusetts, the Striped Bass recreational fishery harvested over four times the commercial sector in 2014 [20, 44]. In the Massachusetts' recreational Striped Bass fishery, there is also a disconnect between management and angler preferences, as anglers were least supportive of reduced bag limit regulations that were recently implemented by managers [13].

Precise knowledge of Striped Bass biology, as defined in this study, did not directly relate to support for management measures; however, anglers that believed Striped Bass grow and reach maturity slowly were clearly more supportive of more restrictive policies aimed at sustaining Striped Bass populations. There were a number of underlying stakeholder characteristics that appeared to track with management support, but angler perceptions of fish maturation, unlike precise knowledge, consistently predicted support for both input and output controls. Importantly, these results illustrate that it is less crucial that anglers know the exact age at which fish mature, but that they recognize Striped Bass require many years to reach

366 reproductive maturity. Therefore, individual perceptions, as opposed to absolute knowledge, may
367 ultimately be more powerful predictors of support for management measures. While behavior is
368 often difficult to alter, this finding has promising implications for stakeholder education
369 initiatives, since precise knowledge is not required for pro-environmental opinions. Although
370 incorporating social dynamics into fisheries management can be challenging, this study provides
371 a template to examine how different angler groups perceive policies, which could consequently
372 aid in improving stakeholder inclusion, trust in the management process, and compliance.

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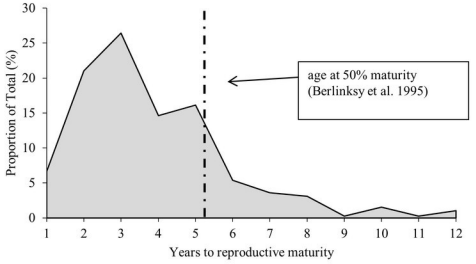
Figure 1. Accuracy of knowledge among recreational Striped Bass anglers. a) The shaded gray area represents the age at which respondents believe female Striped Bass are reproductively mature. The dotted line indicates the age at which 50% of female fish are mature. b) The shaded area represents the age at which respondents believe Striped Bass reach 40” in total length. The dotted line indicates the approximate age of a 40” fish.

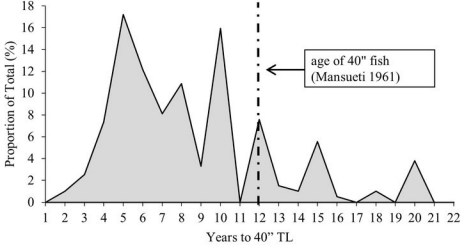
Figure 2. Angler characteristics related to perceptions. Regression tree analysis was used to assess which angler characteristics (e.g. recent commitment) correlate with respondents’ estimates of Striped Bass age at maturity and age to 40” total length. Splits were considered significant at $p<0.05$. For both metrics, fishing experience was the only significant explanatory variable revealed using regression tree analysis with all angler characteristics included as candidates.

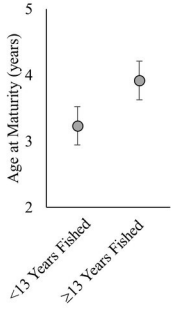
Figure 3. The relationship between angler characteristics, perceptions, and support for recreational regulations. Solid arrows indicate positive relationships while dotted arrows indicate negatives relationships.

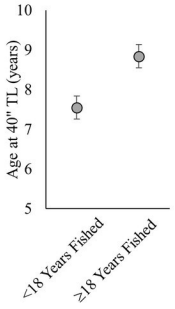
a) Female reproductive maturity



b) Growth




5
4
3
2
Age at Maturity (years)
<13 Years Fished
≥13 Years Fished


10
9
8
7
6
5
Age at 40" TL (years)
<18 Years Fished
≥18 Years Fished

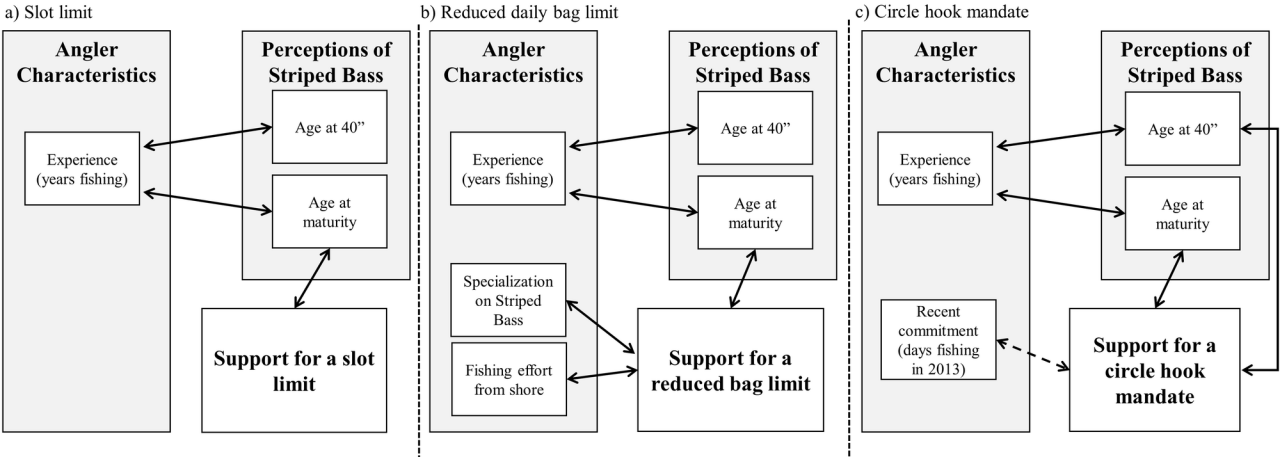

a) Slot limit
Angler Characteristics
Experience (years fishing)
Perceptions of Striped Bass
Age at 40"
Age at maturity
Support for a slot limit
b) Reduced daily bag limit
Angler Characteristics
Experience (years fishing)
Specialization on Striped Bass
Fishing effort from shore
Perceptions of Striped Bass
Age at 40"
Age at maturity
Support for a reduced bag limit
c) Circle hook mandate
Angler Characteristics
Experience (years fishing)
Recent commitment (days fishing in 2013)
Perceptions of Striped Bass
Age at 40"
Age at maturity
Support for a circle hook mandate

Table 1. Summary of survey questions analyzed

Angler Classification	
	Total Striped Bass caught in previous season (i.e., recent commitment)
	Days fished in previous season (i.e., recent commitment)
	Years fishing for Striped Bass (i.e., experience)
	Percent fishing effort from shore (not from a boat)
	Percent fishing effort allocated to Striped Bass (i.e., specialization)
Knowledge and Perceptions of Striped Bass Biology	
	Age at maturity
	Age at 40” total length
Policy Supportiveness	
	Slot limit
	Reduced daily bag limit (from two to one fish per day)
	Circle hook mandate

Table 2. Results of statistical analyses

a) Knowledge of Striped Bass biology

	Sample Size	Average age selected	Actual age
Female age at maturity	390	3.82	5.3
Age to 40" TL	395	8.54	12

b) Perceptions and knowledge of Striped Bass biology versus support for policy changes

Slot limit

	Supported		Opposed		
	Mean	*SE*	Mean	*SE*	*p-value*
Age at Maturity	4.17	0.16	3.41	0.16	0.004*
Age to 40" TL	8.86	0.29	8.31	0.39	0.205
Accuracy of Maturity Estimate	2.12	0.10	2.21	0.12	0.441
Accuracy of Growth Estimate	4.54	0.17	4.93	0.26	0.371

Reduced bag limit

	Supported		Opposed		
	Mean	*SE*	Mean	*SE*	*p-value*
Age at Maturity	4.16	0.18	3.66	0.14	0.014*
Age to 40" TL	8.99	0.37	8.43	0.3	0.208
Accuracy of Maturity Estimate	2.01	0.11	2.2	0.09	0.116
Accuracy of Growth Estimate	4.53	0.23	4.84	0.19	0.299

Circle hook mandate

	Supported		Opposed		
	Mean	*SE*	Mean	*SE*	*p-value*
Age at Maturity	4.15	0.17	3.57	0.19	0.042*
Age to 40" TL	9.24	0.35	7.86	0.35	0.031*
Accuracy of Maturity Estimate	2.08	0.10	2.20	0.13	0.499
Accuracy of Growth Estimate	4.64	0.21	4.78	0.25	0.646

c) Factors related to support for policy changes (logistic regressions)

	Slot limit		Reduced bag limit		Circle hook mandate	
	Sample Size	*p-value*	Sample Size	*p-value*	Sample Size	*p-value*
Age at Maturity	320	0.001*	335	0.03*	273	0.03*
Age to 40" TL	323	0.25	338	0.23	274	0.009*
Accuracy of Maturity Estimate	320	0.57	335	0.18	273	0.50
Accuracy of Growth Estimate	323	0.20	338	0.29	274	0.69
Total Striped Bass caught	179	0.49	179	0.78	147	0.99
Days fishing	333	0.67	348	0.55	279	0.03*
Years fishing for Striped Bass	320	0.11	334	0.66	270	0.14
Fishing effort from shore	282	0.38	292	0.01*	237	0.18
Effort allocated to Striped Bass	331	0.94	345	0.03*	282	0.84