

# Covid19 Policy Stringency and Outdoor Recreation The Case of Resident Marine Sportfishing in the United States

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## Abstract

Governments responded to the Covid-19 pandemic with different policies to curtail the spread of the virus. We show how sportfishing levels are related to the stringency of Covid-19 policies. Specifically, the number of sportfishing trips increases at a decreasing rate as Covid-19 policies become more stringent.

## Author summary

He does this and that.  
*Text based on plos sample manuscript, see*  
*<https://journals.plos.org/ploscompbiol/s/latex>*  
blah blah

## Introduction

- Intro to C-19 and the anecdotal evidence related to C-19 and recreation
- Literature review
- Research question: How do outdoor recreation levels change as governments institute policies to protect public health during a pandemic?
- Approach: variation in state stringency policies to identify the effect of C-19 on sportfishing levels

Landry et al (2021) provide a useful summary of potential causal pathways through which COVID-19 may affect ourdoor recreation: 1. blah 2. Blah blah 3. Blah blah blah To which we may add: 4. Etc 5. Etc etc

## Methods

### Data

We assemble monthly observations from 2017-2020 for three different modes of fishing: private boats, charter boats, and shore. With 4 years, 12 months in each year and 16 states, the data set for each mode has 768 observations.

- MRIP monthly estimates (via program) by mode (private, charter, shore) for each state bordering the Atlantic and Gulf of Mexico

- refer to MRIP website with template programs 21
  - potential issue with PSEs 22
  - Only residents (show percentage of res. vs nonres.) 23
- Annual population estimates for each state bordering the Atlantic and Gulf of Mexico 24
  - 2017-2019: ACS 26
  - 2020 Census 27
- Monthly C-19 Stringency index for each state bordering the Atlantic and Gulf of Mexico 28
  - daily estimates summed to each month[a] 30
  - higher numbers equate with more stringent policies 31

## Modeling Approach 32

Quasi-poisson regression estimated with mean equal to  $\exp(pop) * \exp(xb)$  and variance equal to  $scale * mean$ . 33  
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## Results 35

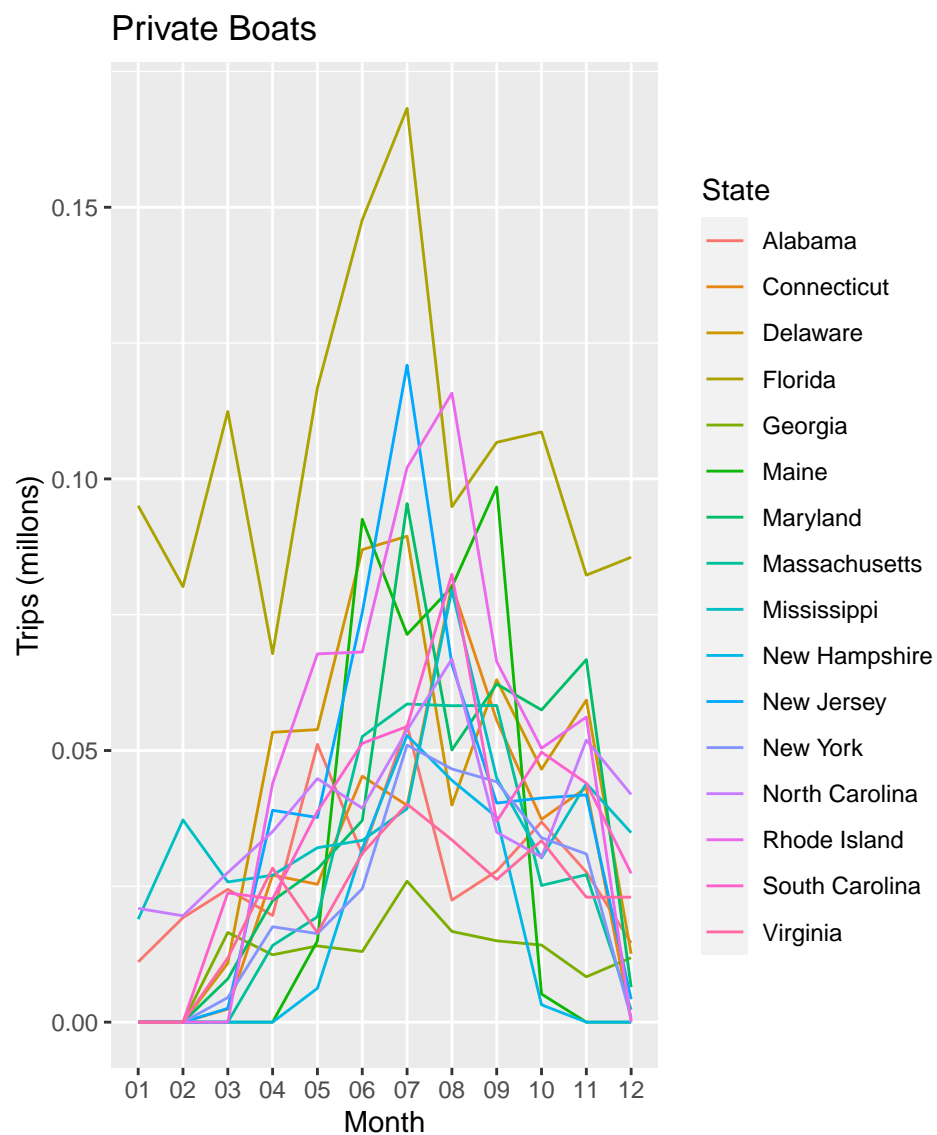
Our results represent a composite effect of the actual local COVID policies, as well as localized attitudes, risk tolerances, and beliefs about COVID-19 which are correlated with COVID stringency. In particular, we see the inverse-U relationship we find to be the outcome of 2 countervailing pathways (laid out in the background section), (1) stringency reduces available substitutes of indoor or high-density outdoor activities, increasing the attractiveness of fishing, which is the dominant force on the low-stringency side of the curve, and (2) COVID risk makes even a relatively distanced activity, such as fishing, less appealing compared to entirely in-home activities such as cooking, backyard games, video games, etc., which is the dominating force on the high-stringency side of the curve. 36  
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## References 46

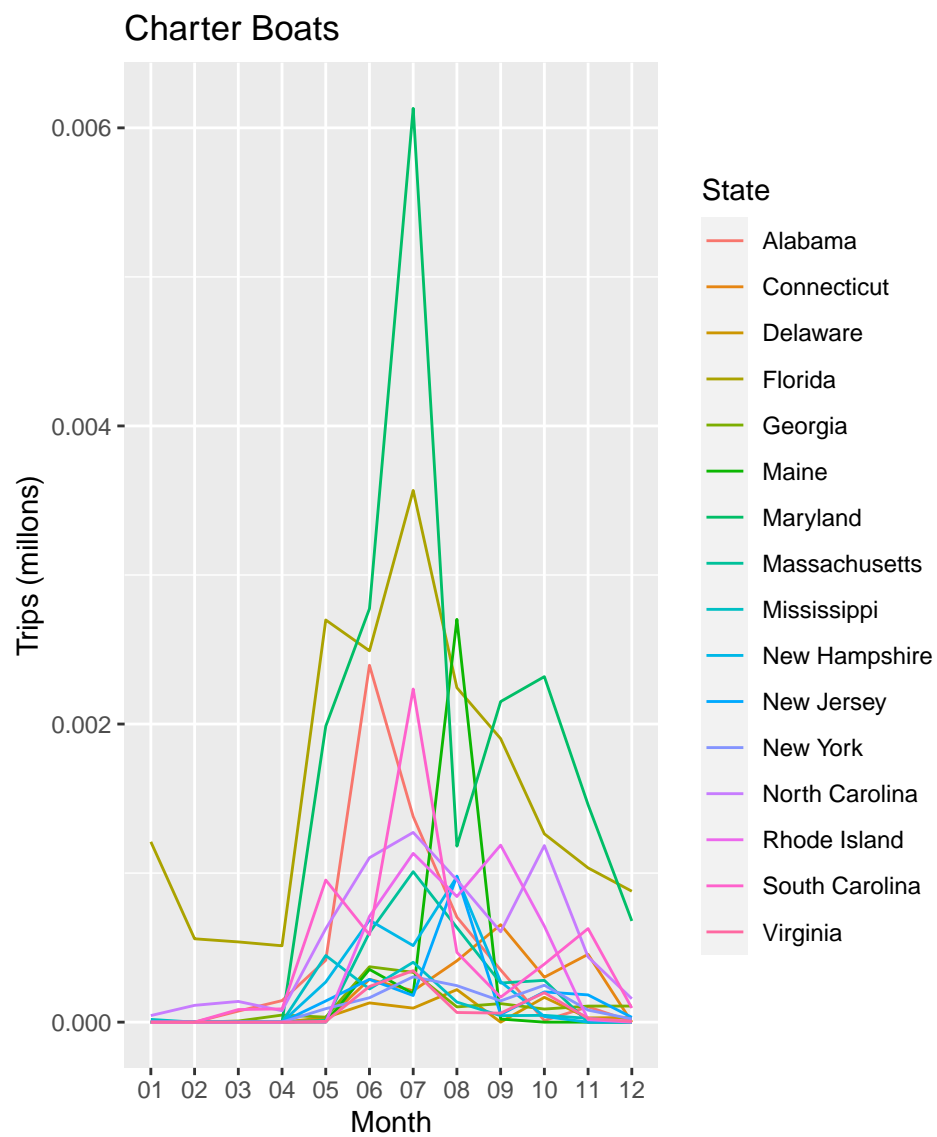
[a]why not average? Different months have different numbers of days 47

**Table 1.** Mean Estimates by Mode and State

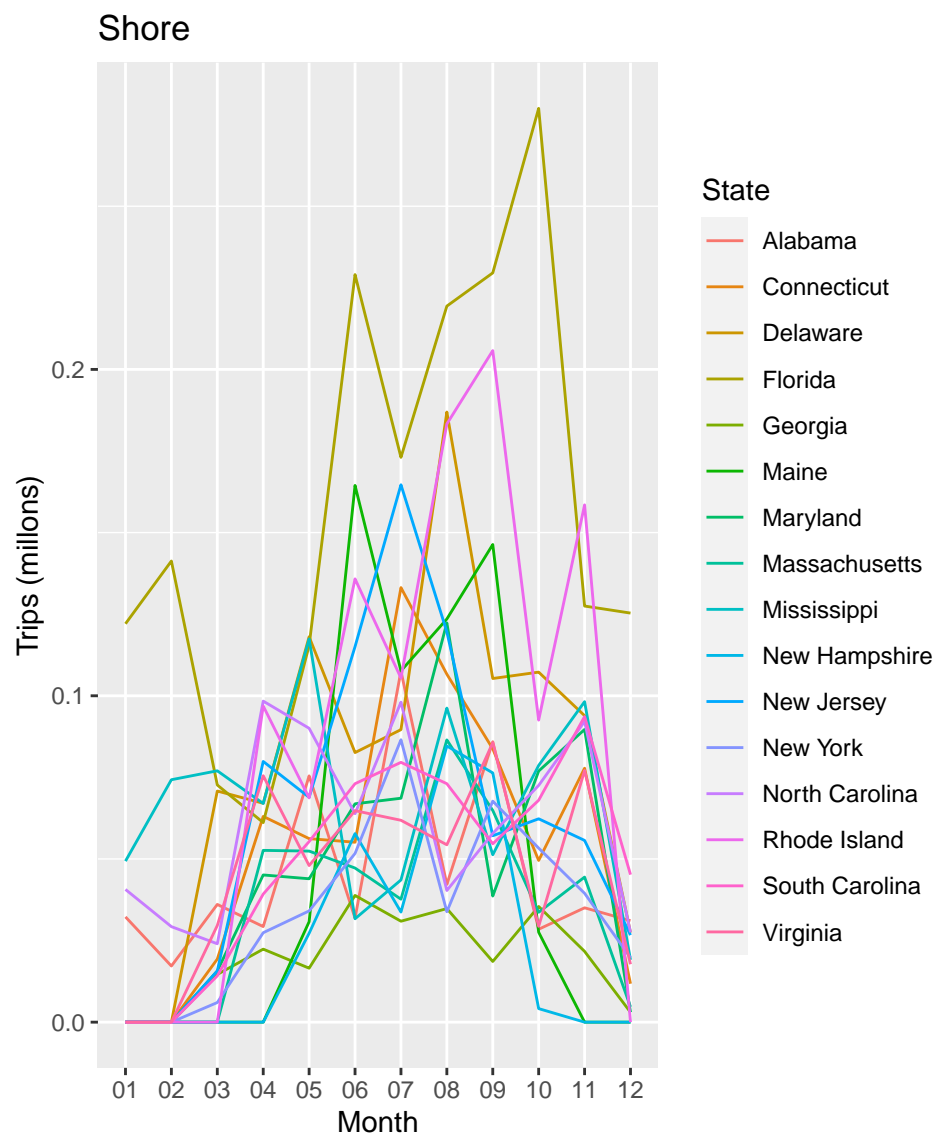
State	Mode	Trips	Stringency	Trips/Pop (2020)	Trips/Pop (before 2020)	Trips/Pop (ratio)
Alabama	3	231279	1310	0.046	0.049	0.948
Connecticut	3	197226	1760	0.055	0.047	1.161
Delaware	3	78288	1693	0.079	0.080	0.989
Florida	3	3403822	1534	0.158	0.149	1.058
Georgia	3	211386	1591	0.020	0.018	1.081
Maine	3	68148	1914	0.050	0.044	1.133
Maryland	3	293858	1678	0.048	0.045	1.062
Massachusetts	3	248415	1632	0.035	0.043	0.831
Mississippi	3	198339	1486	0.067	0.071	0.945
New Hampshire	3	32587	1443	0.024	0.015	1.546
New Jersey	3	592567	1611	0.064	0.052	1.237
New York	3	706673	1891	0.035	0.031	1.143
North Carolina	3	639075	1664	0.061	0.071	0.863
Rhode Island	3	95737	1782	0.087	0.071	1.234
South Carolina	3	254181	1483	0.050	0.054	0.916
Virginia	3	391248	1519	0.045	0.035	1.306
Alabama	5	2336	1310	0.000	0.001	0.835
Connecticut	5	700	1760	0.000	0.000	0.949
Delaware	5	58	1693	0.000	0.000	0.803
Florida	5	33921	1534	0.002	0.001	1.338
Georgia	5	1182	1591	0.000	0.000	0.991
Maine	5	371	1914	0.000	0.000	2.208
Maryland	5	9614	1678	0.002	0.001	1.292
Massachusetts	5	1640	1632	0.000	0.001	0.385
Mississippi	5	331	1486	0.000	0.000	0.536
New Hampshire	5	316	1443	0.000	0.000	0.550
New Jersey	5	1593	1611	0.000	0.001	0.222
New York	5	2181	1891	0.000	0.000	0.629
North Carolina	5	5841	1664	0.001	0.000	1.618
Rhode Island	5	415	1782	0.000	0.000	1.238
South Carolina	5	2429	1483	0.000	0.000	1.019
Virginia	5	678	1519	0.000	0.000	0.713
Alabama	7	142542	1310	0.028	0.030	0.948
Connecticut	7	107241	1760	0.030	0.028	1.050
Delaware	7	42556	1693	0.043	0.040	1.087
Florida	7	2272706	1534	0.106	0.103	1.029
Georgia	7	132066	1591	0.012	0.011	1.077
Maine	7	41174	1914	0.030	0.029	1.046
Maryland	7	223460	1678	0.036	0.031	1.162
Massachusetts	7	184967	1632	0.026	0.029	0.901
Mississippi	7	110395	1486	0.037	0.038	0.971
New Hampshire	7	20248	1443	0.015	0.017	0.857
New Jersey	7	363044	1611	0.039	0.034	1.162
New York	7	455338	1891	0.023	0.024	0.927
North Carolina	7	406368	1664	0.039	0.033	1.169
Rhode Island	7	52188	1782	0.048	0.041	1.161
South Carolina	7	184038	1483	0.036	0.038	0.948
Virginia	7	192082	1519	0.022	0.020	1.087



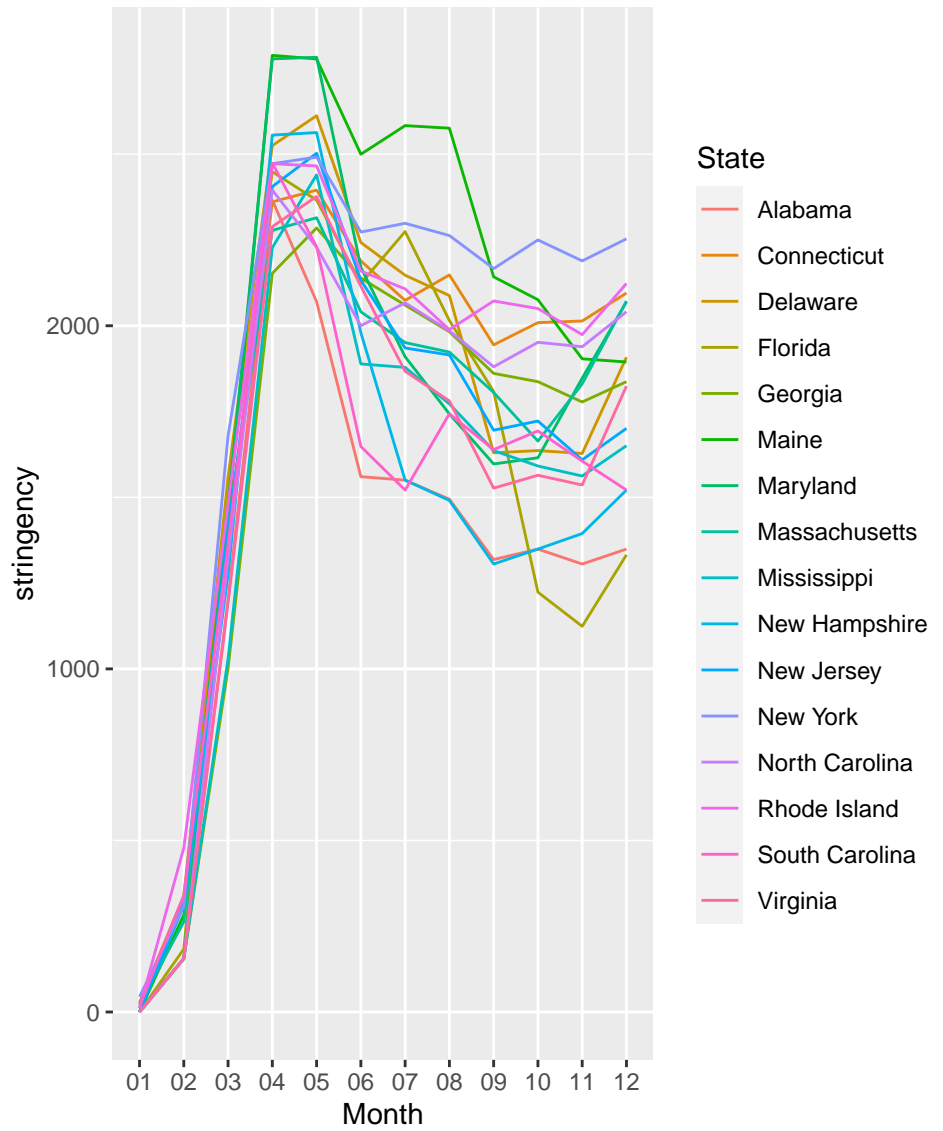
**Fig 1.** 2020 Monthly Marine Sportfishing Trips per Capita by State



**Fig 2.** 2020 Monthly Marine Sportfishing Trips per Capita by State

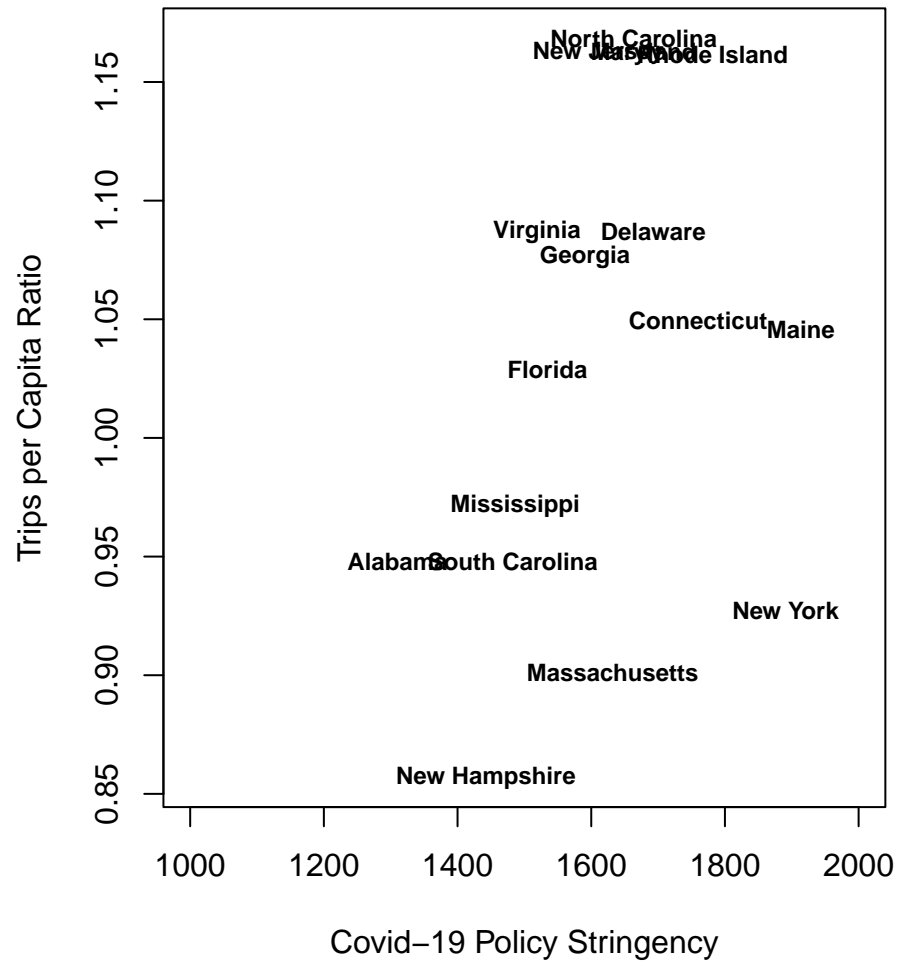


**Fig 3.** 2020 Monthly Marine Sportfishing Trips per Capita by State



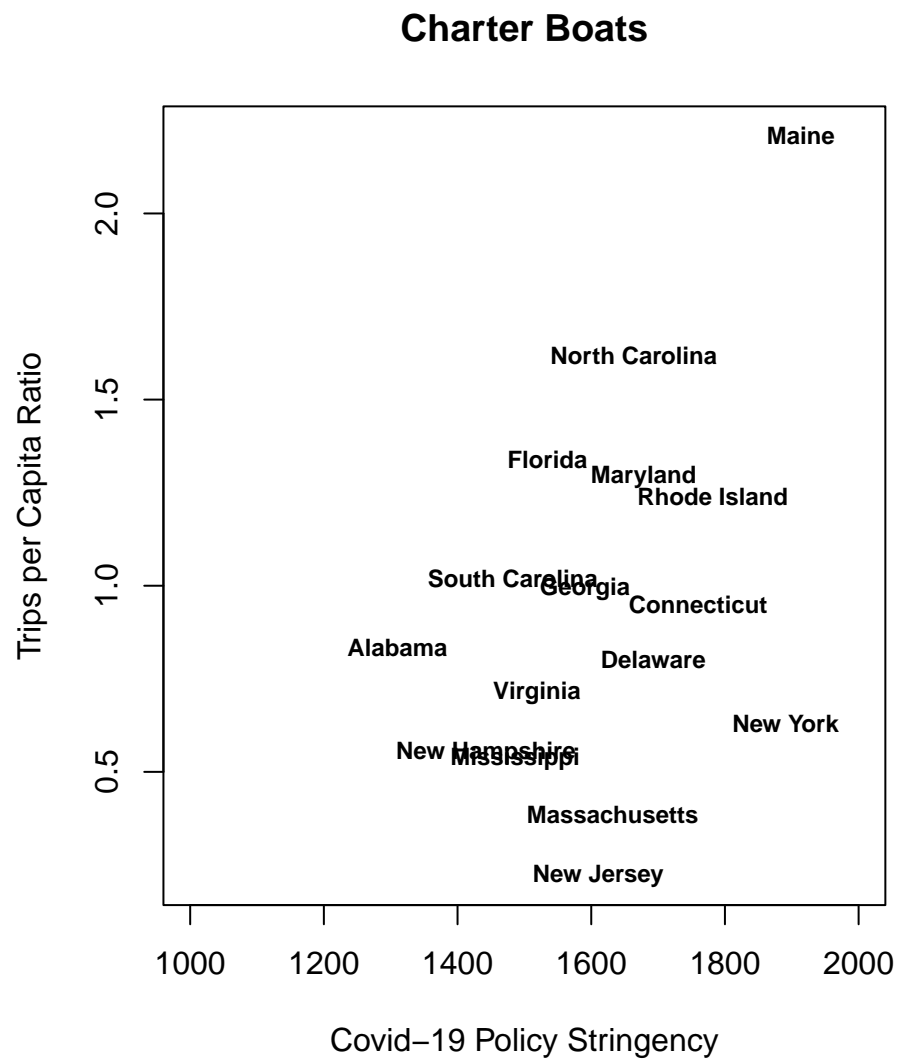
**Fig 4.** Monthly 2020 stringency Index by State

## Private Boats

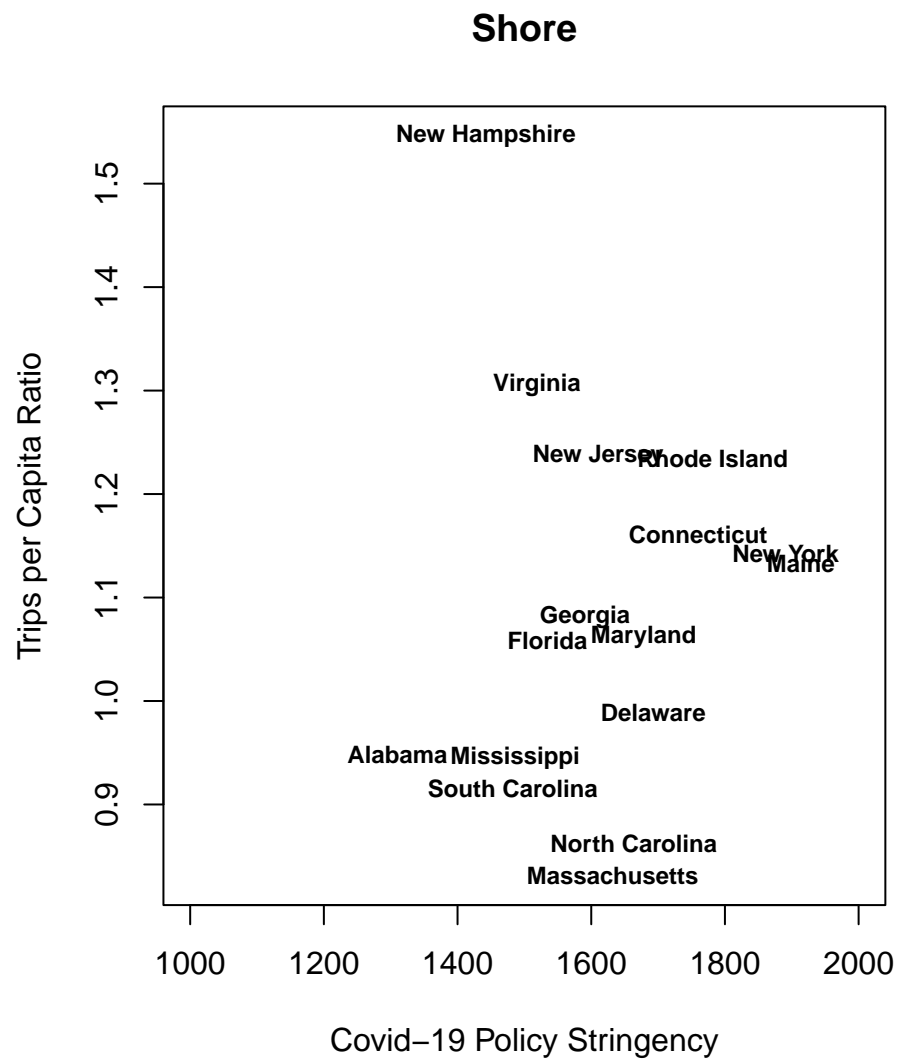


**Fig 5.** Average Trips per Capita versus Covid-19 Policy Stringency





**Fig 6.** Average Trips per Capita versus Covid-19 Policy Stringency

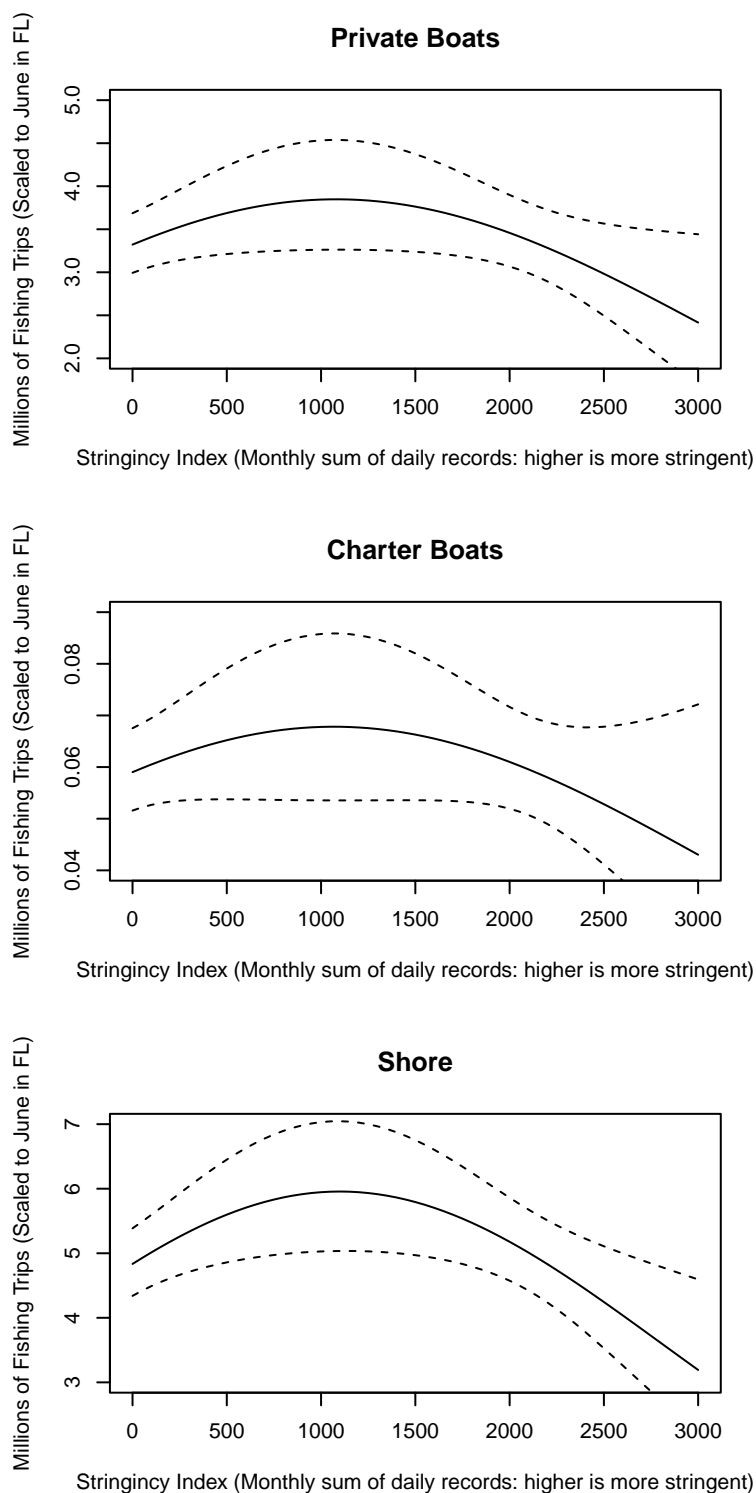


**Fig 7.** Average Trips per Capita versus Covid-19 Policy Stringency

**Table 2.** Quasi-Poisson Fixed Effect Regression of Trips on Covid-19 Stringency by Mode

	Private	Charter	Shore
Intercept	−4.487 (0.137)***	−9.083 (0.227)***	−3.729 (0.130)***
Connecticut	−0.006 (0.153)	−0.947 (0.267)***	0.053 (0.151)
Delaware	0.335 (0.214)	−2.021 (0.783)*	0.537 (0.198)**
Florida	1.269 (0.102)***	0.893 (0.130)***	1.172 (0.102)***
Georgia	−0.912 (0.146)***	−1.552 (0.223)***	−0.924 (0.146)***
Maine	0.032 (0.214)	−1.151 (0.449)*	0.006 (0.218)
Maryland	0.114 (0.130)	0.907 (0.144)***	−0.024 (0.135)
Massachusetts	−0.022 (0.130)	−0.028 (0.164)	−0.145 (0.134)
Mississippi	0.265 (0.149)	−1.052 (0.298)***	0.391 (0.144)**
New Hampshire	−0.574 (0.269)*	−0.359 (0.309)	−1.002 (0.327)**
New Jersey	0.186 (0.119)	0.163 (0.151)	0.152 (0.120)
New York	−0.180 (0.114)	−1.198 (0.170)***	−0.368 (0.117)**
North Carolina	0.180 (0.117)	−0.271 (0.159)	0.381 (0.114)***
Rhode Island	0.391 (0.202)	−0.475 (0.363)	0.478 (0.196)*
South Carolina	0.243 (0.131)	−0.126 (0.179)	0.112 (0.135)
Virginia	−0.333 (0.133)*	−1.641 (0.248)***	−0.233 (0.130)
February	0.334 (0.125)**	0.191 (0.258)	−0.012 (0.121)
March	0.366 (0.125)**	0.585 (0.238)*	0.070 (0.119)
April	0.909 (0.115)***	1.003 (0.226)***	0.721 (0.107)***
May	1.051 (0.113)***	1.902 (0.206)***	0.806 (0.105)***
June	1.358 (0.108)***	2.301 (0.201)***	1.073 (0.100)***
July	1.499 (0.107)***	2.344 (0.201)***	1.069 (0.100)***
August	1.356 (0.108)***	2.075 (0.203)***	0.935 (0.102)***
September	1.070 (0.111)***	1.464 (0.212)***	0.798 (0.104)***
October	0.927 (0.114)***	1.289 (0.216)***	0.790 (0.104)***
November	0.875 (0.115)***	1.203 (0.218)***	0.655 (0.106)***
December	0.335 (0.126)**	0.659 (0.235)**	−0.045 (0.123)
Stringency/100	0.027 (0.013)*	0.026 (0.019)	0.038 (0.013)**
(Stringency/100) <sup>2</sup>	−0.001 (0.001)*	−0.001 (0.001)	−0.002 (0.001)**
Scale	67644.479	1926.588	110073.475
Deviance	55884180.463	1371580.349	90756332.568
Num. obs.	768	768	768

\*\*\*  $p < 0.001$ ; \*\*  $p < 0.01$ ; \*  $p < 0.05$ . The base state is Alabama and the base Month is January.



**Fig 8.** Predicted Trips as a Function of the Stringency Index