Biodiversity Conservation Policy Unintentionally Boosted Science Research[*]

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Abstract

Beyond achieving their intended ecological outcomes, biodiversity conservation policies can create spillovers by altering the availability of resources for innovation. This study investigates the impact of the 2003 fishing ban in the Yangtze River on public funding for research and subsequent outputs related to the river's fish species. The analysis reveals that the ban spurred more quality research inquiries about Yangtze River fish: Funded programs doubled and funding amounts more than tripled. Scientific output grew dramatically, with publications more than tripled, citations augmented more than five-fold, and related books, patents, awards, and public influence significantly increased. We attribute these increases to the enhanced availability of biological research materials (in both quantity and diversity), rather than other attention-based or policy-based channels.

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1 INTRODUCTION

Environmental conservation policies are typically justified by their ecological benefits, while their economic consequences are often viewed through the lens of compliance costs and foregone development opportunities (Greenstone, 2002; Ryan, 2012; He *et al.*, 2020). The broader returns to conservation remain incompletely understood, raising the risk that natural capital is systematically undervalued in policy decisions. This paper proposes and studies a distinct but largely overlooked channel through which conservation can generate economic value: by expanding the supply of scientific research inputs. In many areas of scientific inquiry—especially in the life sciences—living organisms are essential materials for experimentation, replication, and discovery. By preventing species depletion and preserving biodiversity, conservation policies can relax material constraints on research, stimulate scientific inquiry, and attract public research funding. We therefore ask whether biodiversity conservation policies can unintentionally accelerate scientific research and innovation by safeguarding the biological resources on which science itself depends.

To investigate this question, we draw on evidence from a major biodiversity conservation policy in China—the Yangtze River fishing ban. The Yangtze River, China's longest and the world's third longest river, has long been hailed as a biodiverse haven (Fu *et al.*, 2003; Chen *et al.*, 2009). However, overfishing and climate change have severely depleted its fishery resources by the turn of the century (Qiu, 2012; Wang *et al.*, 2022). To restore the fishery resources and biodiversity of the Yangtze River, the Chinese government initiated an annual spring fishing ban in 2003. Previous studies have shown that such fishing management or catch limits have a positive impact on fish species richness and abundance (Frank & Oremus, 2025; Hilborn *et al.*, 2020; MacNeil *et al.*, 2020). This fishing ban in China was primarily designed for the sustainable development of fishery resources, rather than intentionally targeting scientific objectives. This makes it an ideal policy intervention to study the impact of biodiversity conservation on public funding for research and subsequent outputs, primarily through its effect on the availability and diversity of biological materials for research purposes.

A key empirical challenge in assessing the fishing ban stems from its geographic scope. Because the policy applies exclusively to the Yangtze River Basin, any observed effect on research could be confounded by systematic regional differences in economic development, research investment, or political priorities between the basin and other areas. To isolate the causal impact of the policy from these pre-existing disparities, we implement a difference-in-differences strategy that exploits variation across fish species rather than across regions. Specifically, we construct a species-year panel covering 1,562 fish species, of which 320 are Yangtze River fish (YRF) species and 1,242 are non-YRF species. For each species and year, we track public research funding and subsequent scientific outputs. This species-year level design offers a critical advantage: species classifications and habitats are determined by biological and ecological histories, not by contemporary policy or research agendas. Since the fishing ban covers the entire river basin, it cannot be selectively targeted toward species with greater research potential. This feature mitigates concerns about endogenous treatment assignment and facilitates a cleaner identification of the policy's effect on scientific activity.

To construct species-level measures of research inquiries and subsequent outputs, we collect program-level grant data on China's most important research funding system—the National Natural Science Foundation of China (NSFC)—between 1995 and 2014. Using natural language processing techniques based on a corpus of fish species taxonomic systems, we match funded programs with specific fish species. This approach, which traces the scientific pipeline from research funding to subsequent outputs, offers several advantages over existing literature that begins with publications. Most importantly, grant awards capture research activity at an earlier stage, before program execution and publication decisions. In addition, NSFC grants are highly competitive, with an approval rate of approximately 15 percent, making funded programs a meaningful proxy for the capacity to conduct high-quality scientific research. Moreover, the centralized annual application and peer-review process ensures both the timeliness and consistency of funding decisions across years. Finally, mandatory progress reporting for funded programs allows us to systematically link funding inputs to downstream scientific outputs, enabling the construction of a comprehensive species-year level research database covering grants, publications, and their impacts.

We compare changes in scientific inquiry and output—measured by the number of funded programs, total funding amounts, publications per program, and citation counts per paper—between YRF and non-YRF species before and after the fishing ban. We designate 2003, the year the ban was launched, as the start of the treatment period. We document a significant surge in this inquiry and its resultant output for YRF following the ban, compared to non-YRF. Related funded programs and funding amounts more than tripled. Scientific output grew dramatically, with publications more than tripled, and citations augmented more than five-fold. The results are robust to a series of checks including the inclusion of additional fixed effects, alternative citation windows, and sample restrictions. Event studies show that YRF and non-YRF display similar trends in these outcomes in the period before the introduction of the fishing ban, lending support to our identification assumptions. The ban also increased related books, patents, awards, and public influence—indications of broader societal impact.

We further examine various economic mechanisms that could explain the observed boost in scientific research following the fishing ban, focusing on three non-mutually exclusive channels: (1) direct government policies explicitly aimed at promoting YRF research, (2) a surge in public and academic attention that heightened research interest in YRF, and (3) an increase in the availability of biological research materials due to the recovery of fish populations. To investigate the first channel, we systematically analyze the content of relevant policy documents and official communications from funding agencies, searching for specific directives or incentives that would explicitly encourage YRF-related scientific research. We find no substantive evidence of such targeted research mandates. To examine the second channel, we employ two approaches. First, we track the dynamics of media coverage related to the ban to gauge changes in public interest. Second, we analyze funding patterns to test whether research efforts shifted disproportionately toward more salient species (e.g., those that are rare and thus typically attract more scholarly interest). However, our analysis finds no evidence to support this.

The evidence is most consistent with the third mechanism, which posits that the fishing ban stimulated research by improving the availability of biological materials. We subjected this mechanism to three tests. First, we expect that institutions in closer geographical proximity to the Yangtze River should exhibit a more pronounced research boost, as they face lower logistical barriers to collecting and utilizing such biological materials. Second, we expect that the effect should be concentrated on non-extinct species, because these populations are ecologically capable of restoring under protection, thereby directly enlarging the pool of organisms rather than just historical records. Third, we expect a stronger research response for species located in non-upstream sections of the Yangtze River, where the ban's restorative impact was stronger. The results from these tests consistently supported this mechanism, confirming that the policy's primary effect on science was through a supply-side shock, which increased biological materials and thereby fueled the research surge.

This paper contributes to three strands of literature. First, we contribute to the literature on the value of biodiversity and nature. Seminal contributions by Weitzman (1992, 1993, 1998) measure the "value of diversity"; Heal (2000) provides an overview of biodiversity's services, and Brock & Xepapadeas (2003) integrates ecological and economic frameworks for valuing biodiversity. However, the magnitude of biodiversity's value in specific applications remains debated; for example, its pharmaceutical value through bioprospecting is contested (Simpson *et al.*, 1996; Rausser & Small, 2000). Recent works have further documented benefits like boosting agricultural productivity (Frank *et al.*, 2024), reducing human health risks (Frank & Sudarshan, 2024; Frank, 2024; Keesing & Ostfeld, 2021) and improving amenity (Cornaggia *et al.*, 2025; Han *et al.*, 2024). Our study supplements the theoretical literature on the scientific value of biodiversity with empirical evidence. By demonstrating that conservation policies can accelerate scientific progress, we broaden the scope of biodiversity's documented economic and social benefits.

Second, we contribute to the literature on the economics of data, particularly regarding how data enhances science. As noted by Veldkamp & Chung (2024), data's non-rivalrous characteristics make it a key factor of production that drives innovation. The model developed by Jones & Tonetti (2020) further demonstrates that data can boost total factor productivity and generate increasing returns to scale, similar to the accumulation of new ideas, thereby providing a fundamental impetus for sustained economic growth. Recent empirical studies have begun to document the tangible effects of data in specific scientific and economic contexts, demonstrating its positive impact on scientific output Nagaraj *et al.* (2020) and innovation Beraja *et al.* (2023). While prior studies have explored how data fuels science, we supplement this literature by arguing that nature itself provides a critical data repository, and that access to this biological and material diversity is a key driver of scientific advancement.

Third, this study contributes to the broader literature on the relationship between environmental regulation and innovation. A well-established body of research suggests that environmental regulations raise firms' compliance costs and operational burdens, which in turn incentivize them to pursue eco-friendly innovations (Berrone *et al.*, 2013; Brunnermeier & Cohen, 2003; Calel & Dechezleprêtre, 2016; Kim *et al.*, 2021; Porter & Linde, 1995; Lin *et al.*, 2024). Such regulatory pressures can thus act as a catalyst for the development and adoption of green technologies. This research extends the literature by identifying an alternative way through which environmental conservation fosters innovation, one that is separate from the mechanism of regulation-induced costs and pressures.

2 INSTITUTIONAL BACKGROUND

2.1 THE FISHING BAN IN THE YANGTZE RIVER

The Yangtze River, the longest in China, is a vital part of the nation's natural heritage. From the Tibetan Plateau to the East China Sea, its vast basin spans a wide range of landscapes and climates. This variety has given rise to diverse habitats that support a remarkable wealth of plant and animal life, forming distinct ecological regions along its course.

Since the 1950s, however, increasing human activities have placed the Yangtze under growing threat. Long-term and widespread overfishing, together with the construction of massive water conservancy projects (Duan *et al.*, 2002), have severely damaged the river's ecology, leading to the progressive degradation of its aquatic resources. Overfishing during critical fish spawning periods, in particular, has undermined the replenishment of fish populations. Wang *et al.* (2022) examined the multiple stressors affecting the river-lake ecosystems in the middle and lower Yangtze Basin, noting a collapse in fish catches in recent decades. Their research revealed that intensive overfishing triggers a sharp decline in fish stocks from the 1990s onward.

To safeguard the fishery resources and preserve fish biodiversity in the Yangtze River, the Ministry of Agriculture introduced a spring fishing ban in the middle and lower reaches in 2002. This ban was expanded in 2003 to cover the entire main stem of the river and its major tributaries, with the ban enforced from February to April. The fishing ban has provided crucial protection for fish during their reproductive cycles, effectively curbing overfishing and reversing the decline in fish resources (Wang *et al.*, 2022). Monitoring data released by the Yangtze River Fisheries Research Institute and the Freshwater Fisheries Research Center show that the fishing ban has effectively halted the downward trend in the Yangtze's fishery resources. Key metrics—including fish populations, catch per unit effort, and biodiversity indices—had stabilized.

2.2 THE NATIONAL NATURAL SCIENCE FOUNDATION OF CHINA

The National Natural Science Foundation of China (NSFC) is a vice-ministerial level statutory board under the Ministry of Science and Technology of China. It was created in 1986 and has since become one of the main sponsors of basic scientific research in China. NSFC funds research in eight major areas: math & physics, chemistry, life sciences, geological science, engineering and material science, information science, management science, and medical science.

For the vast majority of its funding initiatives, the NSFC releases its annual call for applications at the beginning of the year, with researchers typically submitting self-initiated proposals shortly thereafter. Results are usually announced a few months later within the same year. Unlike patent applications, which require well-developed technical designs or product prototypes, or papers that must present completed experimental results, NSFC project applications are assessed primarily based on the scientific potential of the proposed research. The underlying idea does not need to be fully realized—it may still be at a conceptual or early-stage form. Nevertheless, the proposal must provide a compelling justification for the idea's feasibility, originality, and potential value. This unique structure allows NSFC applications to more promptly reflect emerging trends and shifts in scientific inquiry.

The National Natural Science Foundation of China (NSFC) grant is widely regarded as the most prestigious and competitive research funding program in China, characterized by its unparalleled academic authority and substantial financial support. Due to its prominence, the program attracts a large number of high-quality applications, resulting in intense competition, with a funding rate of just 11.7% in 2024. Research proposals are typically submitted in the early months of the year. After submission, they undergo a confidential peer review conducted directly by senior experts within the relevant research fields. These experts evaluate each application comprehensively based on key criteria such as scientific innovation, project feasibility, and the principal investigator's research competence and track record. Based on this expert assessment, funding decisions are made. This stringent review mechanism ensures that only the most promising and innovative research projects receive support.

3 DATA AND SUMMARY STATISTICS

We compile an original fish species-level panel dataset from multiple sources spanning from 1995 to 2014. Our dataset covers freshwater and freshwater/saltwater fish from the Yangtze River and non-Yangtze River through the years before and after the fishing ban. The dataset also contains the information of relevant NSFC programs, which allows us to empirically test the effects of the Yangtze River fishing ban on scientific research.

3.1 FISH SPECIES

Data on fish species is merged from four different sources. First, we manually collected all the information about freshwater and freshwater/saltwater fish in China from Cnfishbase (Lu *et al.*, 2023), a comprehensive database of Chinese fish species. This database integrates data from multiple trusted sources, including regional fish monographs, relevant journals and books, and other scientific literature. By synthesizing these diverse inputs, the database Cnfishbase ensures reliability in ichthyological taxonomy through meticulous data verification and comparison. This database includes information about each fish's order, family, species, and habitat. Second, we determine whether a certain fish is distributed in the river according to the Yangtze River Fish List (Yang *et al.*, 2023). Third, based on China's Red List of Biodiversity (2004), we construct a categorical variable (Threatened Level) indicating seven ranked endangered levels: extinct (EX), extinct in the wild (EW), critically endangered (CR), endangered (EN), vulnerable (VU), least concern (LC), and not evaluated (NE). Fourth, we also define whether a fish species is endemic to the upstream of the Yangtze River from Lin *et al.* (2019).

3.2 RESEARCH PROGRAM FUNDING

Data on all funded programs are retrieved from the NSFC website, which provides information on successful applications. For each program, the following information was retrieved: a unique ID, affiliated institution, program title, summary, keywords, research field, year of application, and amount of grant. We identify programs related to each fish species per year based on whether the species is mentioned in the title, summary, or keywords. We then aggregate the number of programs and funding amounts at the species-year level. Information is obtained from the papers published by these programs and their corresponding citations, which are similarly aggregated at the fish species-year level. Due to adjustments to the fishing ban policies after 2015, our sample period is restricted to the year 2014 and earlier. According to the sub-sample statistics in Table 1 Panel B, the total number of funds related to YRF is about 0.11 per year per fish species on average, with a total amount of about 51,240 RMB. The average number of papers generated by YRF-related funded programs is 0.26 and the average citation within five years post-publication for those papers is 0.16.

3.3 DESCRIPTIVE PATTERNS

Table A1 shows the detailed information about fish species and their distribution in the sample. There are 320 fish species distributed in the Yangtze River and 1242 non-Yangtze River. Among them, there are 16 orders and 33 families belonging to the Yangtze River, accounting for 32.65% and 27.73% of all involved orders and families. As for habitat, the vast majority of fish species in both the Yangtze and non-Yangtze rivers are freshwater, accounting for about 94.23%.

4 EVIDENCE ON THE IMPROVEMENT OF SCIENTIFIC RESEARCH BY THE FISHING BAN

4.1 BASELINE EMPIRICAL STRATEGY AND ESTIMATES

We begin examining the impact of the fishing ban in the Yangtze River on project funding in the following standard DiD framework. Specifically, we run the following regression:

$$ScientificResearch_{f,t} = \alpha + \beta_1 YRF_f \times Post_t + \delta_f + \gamma_t + \varepsilon_{f,t}, \tag{1}$$

where f indexes fish species, and t indexes years. The outcomes of interest, denoted $ScientificResearch_{f,t}$, include four metrics: the number of funded programs, the amount of funding (thousand RMB), publications per fund, and citations per paper related to fish f in year t. YRF_f is a dummy variable that equals one if fish f is included in the list of YRF. $Post_t$ is a dummy variable that equals one for the years in and after 2003, the start year of the fishing ban. The equation also contains controls for fish species and year-fixed effects, δ_f and γ_f. $\varepsilon_{f,t}$ is the error term. The fish species fixed effects, δ_f, which are a set of fish-specific dummy variables, can control for time-invariant confounders specific to each fish, such as the family and habitat. The year fixed effects, γ_f, are a set of dummy variables that account for shocks common to all fishes in a given year, such as a national policy. We cluster the standard errors at fish order × year level to account for possible correlations in the residual. The coefficient of interest in Equation (1) is β_1, the estimated impact of the fishing ban on scientific research. We expect the coefficient to be positive, suggesting a greater increase in the scientific research related to YRF.

Table 2 presents the results from estimating the DiD model. Columns 1-4 display the number of funded programs, total funding amount (thousand RMB), average number of papers generated from these programs, and average citations per paper five years post-publication. These results indicate that this fishing ban significantly promoted public funding for research and subsequent outputs.

To estimate the economic impact, we compare the actual outcome with a counterfactual scenario in which the fishing ban was absent. Following the method of Bai *et al.* (2023), we simulate this scenario by setting YRF to zero in Equation (1). This allows us to estimate the scientific research outcomes related to YRF—including funded programs, funding amounts, publications, and citations—that would have occurred without the ban, other things being equal. The difference between this counterfactual estimate and the observed data quantifies the increase in scientific research attributable to the ban. Relative to pre-ban levels and to non-YRF programs, the ban led to an additional 97% increase in the number of funded YRF programs and a 230% increase in related funding. Moreover, YRF is associated with a 273% rise in publications and a 458% increase in citations compared to pre-ban levels.

We also estimate a fully flexible year-by-year specification taking the following form:

$$ScientificResearch_{f,t} = \alpha + \sum_{\tau \neq 2002} \beta_\tau YRF_f \times Year_\tau + \delta_f + \gamma_t + \varepsilon_{f,t} \tag{2}$$

In Equation (2), instead of interacting YRF_f with a post-reform indicator variable, we interact the treatment variable with each year relative to 2002. The estimated vectors of β_τ reveal the relative differences between the treated and control groups in each year. If, for example, the fishing ban increased scientific research, then we would expect the estimate β_τ to be constant for years before the fishing ban and then to increase as the ban began.

We next estimate the event study regressions and summarize the results in Figure 1. The conditional differences between YRF and non-YRF funding, publications and citations are small in magnitude and statistically insignificant before the introduction of the fishing ban. This fact supports the critical parallel trends assumption. There is a lag of approximately three years before the impact on funding becomes statistically significant, likely attributable to the time required for the fish populations to recover, proliferate, and then yield more potential research materials (Figure 1a,b). Due to the exponential path of fish reproduction, the magnitude of the effects becomes ever larger over time. The average number of eventual publications increases right after the fishing ban in part because our publication measure includes all future publications from a program funded in any particular year (Figure 1c). Note also that these publications are supported by the cumulative increase in fish research materials following the ban. The average citations to the research publications also increase after the fishing ban (Figure 1d).

4.2 Robustness Check

To assess the reliability of our baseline findings, we conduct a series of robustness checks, as reported in Table A2 and Table A3. These tests incorporate additional fixed effects and employ alternative measures of research impact. The results consistently support our initial conclusions. Specifically, in Table A2, we augment the baseline specification by including *Family* × *Post* fixed effects, in addition to species and year fixed effects. Across all columns—number of funds, funding amount, publication count, and citation count—the coefficient for the interaction term *YRF* × *Post* remains positive and statistically significant at the 1% level, confirming that the policy effect is robust to more demanding controls for time-varying heterogeneity at the family level.

Furthermore, in Table A3, we explore the sensitivity of citation outcomes to different measurement approaches. Columns (1) to (4) show that the estimated effect grows steadily when citations are measured over longer horizons—from the 5th to the 8th year after publication—suggesting that the policy's impact on research influence becomes more pronounced over time. In Column (5), we exclude fish species that never received research funding. Overall, these results confirm that our main findings are not driven by arbitrary modeling choices and are robust to alternative fixed-effect structures, citation windows, and sample definitions.

4.3 Excluding the Crowding-out Effect

To dispel concerns that the increase in research funding due to fishing bans might "crowd out" the funding that non-YRF programs should have received, we verify in the data that research on non-YRF also received greater funding, witnessed an increase in publications, and garnered more citations than what the pre-ban trend would project. This is shown in Table A4 and Table A5. As such, we infer that the ban did not simply divert funding from non-YRF to YRF programs.

We also investigate whether fish programs divert funding or talent from other disciplines (see Figure A1). First, we confirm that most fish programs (both YRF and non-YRF programs) are categorized under the Fisheries Science discipline within the Life Sciences field (Figure A1a). Second, we analyze the disciplinary distribution of all fish programs within Life Sciences, categorizing them into Fisheries Science programs and non-Fisheries Science programs. We find that, after the fishing ban, the proportion of fish research conducted by non-Fisheries Science does not increase. This implies that fish programs become more concentrated within Fisheries Science after the YRF ban and they do so without attracting resources away from non-Fisheries Science disciplines (Figure A1b). Third, we investigate whether Life Sciences diverts funding from other fields. Time series graphs for the proportions of programs across eight fields including Life Sciences are in Figure A1c. The shares of Life Sciences programs slightly decrease after the ban, further reinforcing that they do not crowd out programs in other fields. In the end, even if there were any crowding-out as a market outcome, it is unlikely to be welfare-reducing, absent salient market frictions.

4.4 Broader Research Impact

We also examine other scientific outputs—–such as patents, awards, and books—–stemming from funded programs, revealing that the fishing ban also stimulates an increase in these diverse forms of YRF research. These results are presented in Columns (1)-(3) of Table 3. Public influence on YRF research also increases following the fishing ban. Here, we use news reports related to fish research to construct the public influence of research each year for each type of fish. More reports typically mean more research activity, as findings are often shared with the public through the media. We classify news reports as "fish research" if they mention a fish species from our catalog and include research-related terms in Table A8. The result in Column (4) of Table 3 shows that there was a significant rise in news reports about YRF research compared to non-YRF research after the fishing ban, indicating increased public influence of YRF research post-ban.

5 Discussion of Mechanisms

5.1 Increase in Research Materials

The main explanation for our main finding, and arguably the most intuitive ex post, is that the implementation of the fishing ban increased the fish population, thus providing a richer biological resource base for scientific study. Note that rigorous scientific research often requires extensive and repeated experimentation to get real and accurate conclusions, a process for which an ample supply of research subjects is indispensable (Callander, 2011; Azoulay *et al.*, 2011; Zhao *et al.*, 2020; Redish *et al.*, 2018). For instance, differential therapeutic effects may arise from varying concentrations of fish oil. High concentrations enhance brain function and address cardiovascular issues, while lower concentrations may contain components increasing cardiovascular risk. Researchers using different amounts of research materials (i.e., fish) may yield divergent conclusions, so the abundance of fish species would be critical for reconciling findings that emerge across different studies(Swanson, 1986; Callaghan *et al.*, 2021).

The ideal approach to evaluating this mechanism would be to examine directly whether the populations of each YRF species increased following the fishing ban. However, there are no official observational records documenting temporal changes in fish populations. Despite these methodological challenges, we attempt to employ three heterogeneity-based indirect approaches to disentangle the potential role of research materials.

First, we consider potential heterogeneity in the access to research materials. In the early 2000s, China's inter-provincial transport infrastructure was underdeveloped, posing significant obstacles for scientists traveling across provinces for research. Given limited mobility, the scholars near the Yangtze River had an inherent advantage in studying the river's fish species. This proximity reduced the logistical and financial costs associated with research, potentially increasing the productivity of local institutions. As a result, we would expect the fishing ban to have a greater impact on scientific research conducted by institutions within the Yangtze River basin than those outside it due to the differential ease of access to research materials. We run the following regression:

$$\begin{aligned} \mathit{ScientificResearch}_{f,p,t} &= \alpha + \beta_1 \mathit{YRF}_f \times \mathit{Post}_t \times \mathit{YRProv}_p + \beta_2 \mathit{YRF}_f \times \mathit{Post}_t \\ &+ \beta_3 \mathit{YRProv}_p \times \mathit{Post}_t + \beta_4 \mathit{YRF}_f \times \mathit{YRProv}_p + \delta_f + \gamma_t + \eta_p + \varepsilon_{f,p,t} \end{aligned} \tag{3}$$

where YRProv_p represents whether a province is geographically proximate to the Yangtze River basin, including 19 provincial-level administrative units: Qinghai, Tibet, Sichuan, Yunnan, Chongqing, Hubei, Hunan, Jiangxi, Anhui, Jiangsu, Shanghai, Guizhou, Gansu, Shaanxi, Henan, Zhejiang, Guangxi, Guangdong, and Fujian. The interest coefficient in the equation, β_1, is anticipated to display a statistically significant positive effect.

Second, we consider the potential heterogeneity in the availability of different types of fishery materials to help us verify this mechanism. Intuitively, the fishing ban would have a less noticeable effect on research related to extinct fish. This is because even the strictest fishing policies cannot bring back extinct fish, thus eliminating the availability of corresponding materials for researchers to study. Consequently, the fishing ban is expected to have a greater impact on research concerning non-extinct fish species than on research of extinct species. We run the following regression:

$$\begin{aligned} \mathit{ScientificResearch}_{f,t} =& \alpha + \beta_1 \mathit{YRF}_f \times \mathit{Post}_t \times \mathit{Non\text{-}Extinct}_f + \beta_2 \mathit{YRF}_f \times \mathit{Post}_t \\ &+ \beta_3 \mathit{Non\text{-}Extinct}_f \times \mathit{Post}_t + \delta_f + \gamma_t + \varepsilon_{f,t} \end{aligned} \tag{4}$$

where $\mathit{Non\text{-}Extinct}_f$ equals one if a fish species is not classified as extinct (EX) or extinct in the wild (EW) according to the threatened level of fish in Table A1, zero otherwise.

Third, we examine the potential heterogeneity among fish populations in the upstream and non-upstream sections of the Yangtze River. The upstream region harbors approximately 90% of the river basin's hydropower infrastructure. Extensive cascade development and river channelization have resulted in significant habitat fragmentation.

Due to these challenging environmental conditions, the recovery effect of the fishing ban on fish populations in the upstream section is likely to have been weaker. Therefore, if the proposed research material mechanism holds, the impact of the fishing ban on research related to fish species in the non-upstream areas of the Yangtze River is more pronounced compared to those in the upstream regions. We run the following regression:

$$\begin{aligned} \mathit{ScientificResearch}_{f,t} =& \alpha + \beta_1 \mathit{YRF}_f \times \mathit{Post}_t \times \mathit{Non\text{-}Upstream}_f + \beta_2 \mathit{YRF}_f \times \mathit{Post}_t \\ &+ \beta_3 \mathit{Non\text{-}Upstream}_f \times \mathit{Post}_t + \delta_f + \gamma_t + \varepsilon_{f,t} \end{aligned} \tag{5}$$

where $\mathit{Non\text{-}Upstream}_f$ equals one if a fish species is classified as being found in the Yangtze River but not endemic to the upstream of the Yangtze River according to the distribution of fish in Table A1.

We interact each variable of interest with the baseline DiD term in our triple-difference regression models, specified in Equation (3), Equation (4) and Equation (5). The point estimates of the coefficients and the 95% confidence intervals are presented in Figure 2. The coefficients are primarily positive, indicating that the mechanism of increased research materials leads to an increase in scientific research (Table 4, Table 5 and Table 6). These heterogeneity results would not have arisen if the ban had not increased fish species as research materials because neither government policies nor private incentives at the time of the ban specifically targeted researchers in the Yangtze River basin. Additionally, non-extinct or non-upstream fish species were not prioritized by such policies or incentives.

We also document evidence of the effect of the increased diversity of fish species after the fishing ban on funded programs. First, we describe in Figure 3a how the reported number of fish species in the Yangtze River declined prior to the ban, but exhibits a gradual increase after the ban, including that for the Hejiang reach, an important part of the Yangtze River. Furthermore, we record the natural fishery catch in the Three Gorges Reservoir area of the Yangtze River, which see a notable increase following the ban. These findings corroborate an increase in fishery resources.

Next, the increase in fish diversity, as seen in Figure 3a, should also increase research diversity if fish species are used in scientific research. We document the patterns in the annual numbers of fish species mentioned in funded programs' published papers affiliated with YRF and non-YRF. As shown in Figure 3b, YRF programs' papers mention more fish species than non-YRF programs' papers following the fishing ban.

5.2 Government Research Policies Concerning YRF Programs

One explanation for our main finding may be that more government policies arise related to, contemporaneous with, or even after, the fishing ban to encourage YRF-related scientific research. To investigate this possibility, we first collect all policy documents related to the fishing ban issued by central government departments during the 1995–2014 period from PKULaw and conduct a textual analysis to test this mechanism. We segment the documents into words and create a word cloud of the 30 most frequent terms (Figure A2). None of the words pertain to scientific research, implying that these policies are unlikely to target scientific research directly.

Second, the main goal of the fishing ban is to protect fish resources in the Yangtze River, which could target research focusing on "Yangtze River" or "fish protection." To test this, we remove funded programs related to "Yangtze River" and "fish protection" from our sample. The main results remain, further invalidating the alternative channel (Table A6).

Third, following the fishing ban, the NSFC committee might have boosted Yangtze River-related research funding by increasing support for such studies. If this mechanism were in place, the committee would have discussed its support for Yangtze River research through media statements. Therefore, we also collect all news reports from the NSFC official website and tag those related to the Yangtze River by year. To investigate whether the increase in fund applications is closely related to the increase in Yangtze River-related policy support of the fund's supply side, we evaluate the changes in the probability of news articles from the NSFC website being classified as "Yangtze River research." The specification is set as follows:

$$\mathbf{1}(\mathit{News\ on\ Yangtze\ River\ Research})_{i,t} = \alpha + \sum_{t=2001}^{2014} \beta_t \mathit{Year}_t + \varepsilon_{i,t} \tag{6}$$

where $\mathbf{1}(\mathit{News\ on\ Yangtze\ River\ Research})_{i,t}$ equals one if the news i contains the term “Yangtze River” along with a list of associated research-related terms in Table A6, zero otherwise. Year_t equals one in year t and zero otherwise. Each observation is a piece of news from the NSFC website. The coefficient β_t captures the change in NSFC’s support for the Yangtze River research year by year.

The result shows no significant change in the support in these news reports post-ban, ruling out this possible channel (Figure A3). In summary, policies directly increasing support for research on the Yangtze River and its fish species following the fishing ban appear absent and, even if present, cannot be the primary driver for our findings.

5.3 Increase in Public Attention to the Fishing Ban

Another possible mechanism through which the fishing ban boosts scientific research is increasing attention in both the public and academic spheres paid to the fishing ban and YRF. We examine the time trend of such attention using the annual ratio of the number of news reports on the “Yangtze River fishing ban” to the number of news reports on the “Yangtze River.” We find that public interest peaks when the ban was implemented in 2003 but decreases afterward, suggesting only a transient surge in attention (Figure A4). However, our baseline regression results show that YRF-related scientific research steadily increases over time. This contrast suggests that the rise in scientific research is unlikely to have been driven by public attention to the fishing ban policy.

Furthermore, we examine whether the public influence on YRF research has increased following the fishing ban. We utilize news reports related to fish research to construct a measure of the public’s impact on research for each type of fish each year. The specification of the event study is set as follows:

$$News\ report\ on\ fish\ research_{f,t} = \alpha + \sum_{r=2000}^{2014} \beta_r\, YRF_f \times Year_r + \delta_f + \gamma_t + \varepsilon_{f,t} \qquad (7)$$

where $News\ report\ on\ fish\ research_{f,t}$ equals the number of news related to research on fish f in year t. A news report is identified as research-related if it includes both the name of a fish species and a set of research-related terms in Table A8. The other terms remain unchanged from Equation (1).

Furthermore, rare fish species—characterized by low population numbers but still with a chance of recovery through conservation efforts—are most likely to capture the attention of researchers among different fish species (Angulo & Courchamp, 2009). Studying rare species may attract more funding and foster more collaboration opportunities and career advancement. The high academic value and research difficulty of these species often lead to publications in high-impact journals, bringing researchers greater achievement and recognition. Thus, if the mechanism of "heightened researcher attention" were in effect, we expect a surge in research focused on these rarer fish species over others. We classify "rare" fish species as those that are categorized as either "critically endangered (CR)," "endangered (EN)" or "vulnerable (VU)."

To test the mechanism that the fishing ban has led to heightened attention from researchers, we run the following regression:

$$\begin{aligned} ScientificResearch_{f,t} = \alpha + \beta_1 YRF_f \times Post_t \times Rare_f + \beta_2 YRF_f \times Post_t \\ + \beta_3 Rare_f \times Post_t + \delta_f + \gamma_t + \varepsilon_{f,t} \end{aligned} \qquad (8)$$

where $Rare_f$ equals one if a fish species is classified as vulnerable (VU) or endangered (EN) or critically endangered (CR), according to the threatened level of fish in Table A1, and zero otherwise.

Contrary to what this channel would imply, the results reveal that research related to rare fish species does not receive a stronger effect than other fish species after the fishing ban (Figure A5 and Table A7).

6 CONCLUSION

This study provides robust empirical evidence that biodiversity conservation policies can generate significant and previously underappreciated socio-economic returns by accelerating scientific innovation. By exploiting the quasi-experimental variation created by China's Yangtze River fishing ban, we demonstrate that a policy primarily aimed at ecological restoration had the unintended consequence of stimulating public research investment and output. The fishing ban led to a dramatic surge in funded research programs, publication volume, and citation impact specifically for the protected YRF species, relative to a control group of non-YRF species. Our findings highlight an important channel through which conservation creates value: by enhancing the availability and diversity of biological materials that serve as critical inputs for scientific discovery. The evidence consistently supports this supply-side mechanism over alternative explanations centered on direct government research supports or transient surges in public and academic attention.

This research broadens our understanding of the full value of biodiversity and natural capital. It suggests that the benefits of conservation extend far beyond direct ecosystem services to include the fostering of new knowledge and innovation—a public good with potentially far-reaching economic implications. By quantifying this scientific value of biodiversity, our findings provide a stronger economic rationale for investments in conservation. Policymakers should consider these indirect but potent benefits when evaluating environmental regulations, recognizing that protecting nature today can fuel the scientific breakthroughs of tomorrow.

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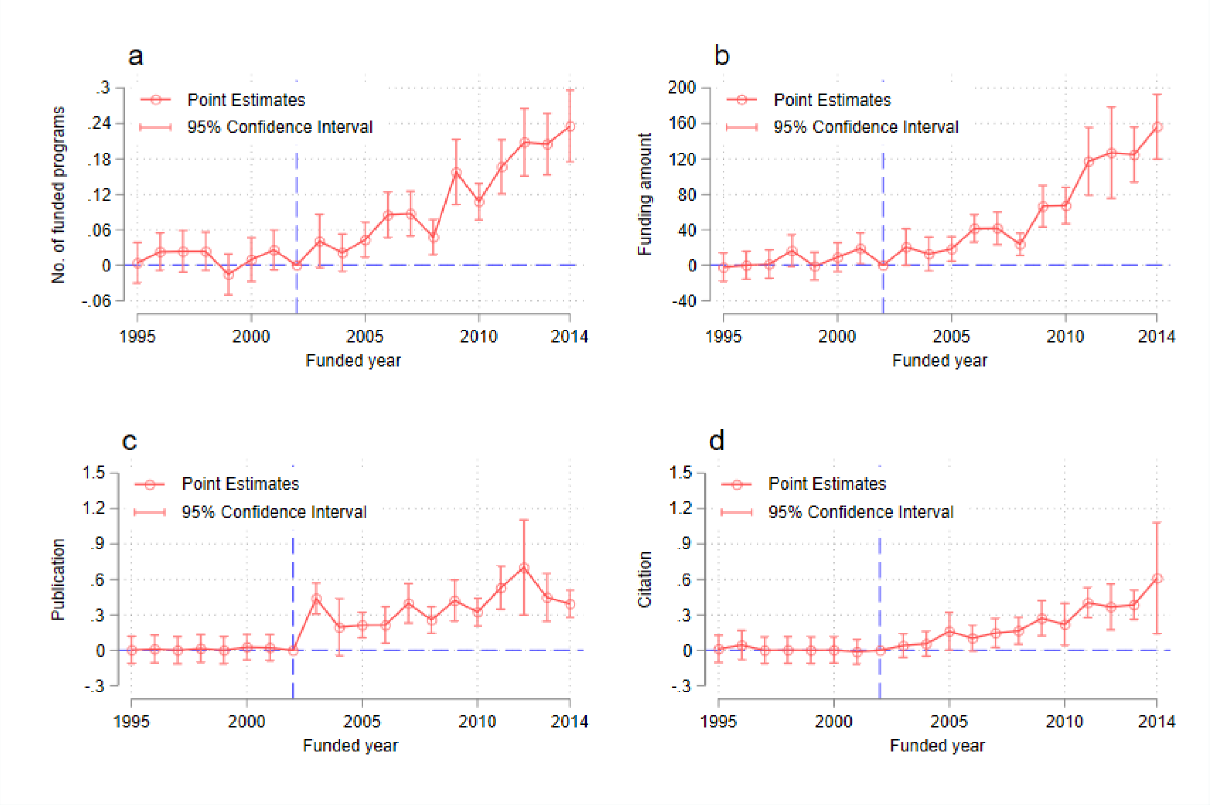
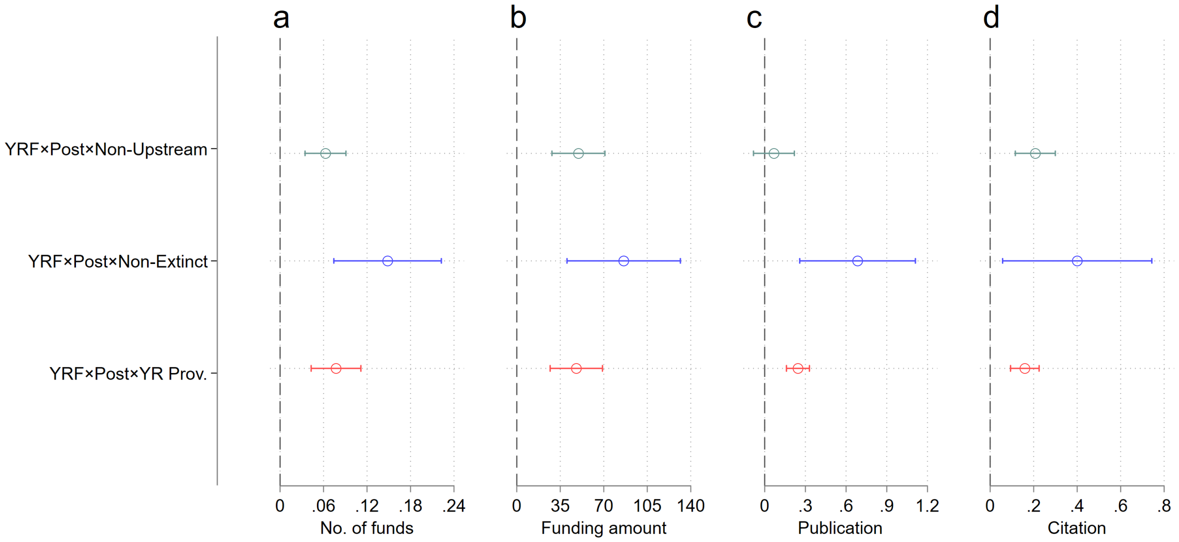
Figures and Tables

Figure 1: Event studies for scientific inquiries and outputs



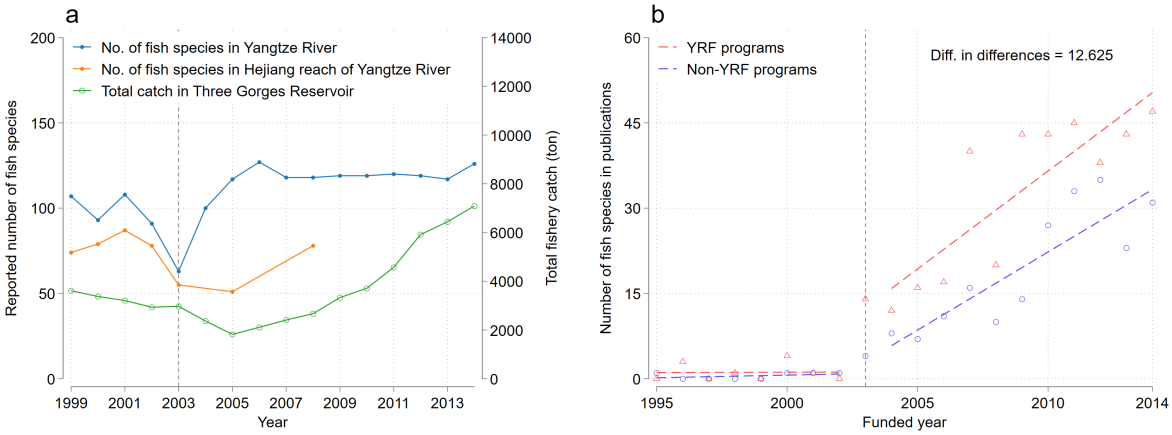
Notes: This figure illustrates the estimated differences in various metrics between Yangtze River fish species and non-Yangtze River fish species before and after the fishing ban, as calculated using Equation (2). Specifically, it examines differences in the number of funded programs (a), the amount of funding (thousand RMB) (b), eventual publications per funded program (c), and citations per published paper (d). The markers and capped spikes represent the OLS estimators and 95% confidence intervals. The sample period covers from 1995 to 2014. The dashed vertical line indicates the time point one year prior to the initiation of the fishing ban. The regression includes fish species fixed effects and year fixed effects. The standard errors are clustered at the fish order × year level.

Figure 2: Heterogeneity of the impact of the fishing ban



Notes: This figure presents the heterogeneity of the impact of the fishing ban on scientific research across different groups. The groups include: (1) Whether the institution to which the fund belongs is located in a province in the Yangtze River Basin, (2) Whether the fish species have become extinct (EX) or extinct in the wild (EW), and (3) Whether the fish species are endemic to the upstream of the Yangtze River. This figure presents the point estimates and 95% confidence intervals of the effects on the number of funds, funding amount (thousand RMB), publications per fund, and citations per paper. The regression includes fish species fixed effects and year fixed effects. The standard errors are clustered at the fish order × year level.

Figure 3: Trend in fish species and number of species in publications



Notes: a, Annual reported number of fish species in the Yangtze River and the Hejiang reach of the Yangtze River. The statistical data is from the Bulletin on the Ecological and Environmental Monitoring Results of the Three Gorges Project issued by the Ministry of Environmental Protection from 2000 to 2015. The blue and orange solid lines represent the trend in the reported number of fish species in the Yangtze River and the Hejiang reach of the Yangtze River. The green solid line represents the trend in total fishery catch in the Three Gorges Reservoir area. The black vertical dashed line indicates the year when the fishing ban started. Due to the major flood that occurred on the Yangtze River in 1998, we are only displaying data from 1999 onwards. b, Number of fish species in the YRF and non-YRF programs' corresponding publications. The red dashed line represents the YRF programs' associated publications, while the blue dashed line represents the non-YRF programs' associated publications. The black dashed vertical line indicates the time when the fishing ban was implemented.

Table 1: Variable definitions and summary statistics

Panel A: Variable definitions and summary statistics

			Full sample	
Variable	**Definition**	**Number of obs.**	**Mean**	**Std. Dev.**
Outcome				
Number	Total number of fish-related funded programs	31240	0.03	0.38
Amount	Total amount of fish-related funded programs (thousand RMB)	31240	12.99	224.98
Publication	Average number of papers published by funded programs	31240	0.08	0.96
Citation	Average citation within five years following publication for papers out of funded programs	31240	0.05	0.79
Treatment				
Yangtze	Takes one if it is included in the list of Yangtze River fish, zero otherwise	31240	0.20	0.40

Panel B: Subsample statistics: funded programs information

			Mean (Std. Dev.)	
Variable	**Sample**	**Number of obs.**	**Mean**	**Std. Dev.**
Number	Yangtze	6400	0.11	0.79
	Non-Yangtze	24840	0.01	0.15
Amount	Yangtze	6400	51.24	463.29
	Non-Yangtze	24840	3.13	87.44
Publication	Yangtze	6400	0.26	1.73
	Non-Yangtze	24840	0.03	0.61
Citation	Yangtze	6400	0.16	1.51
	Non-Yangtze	24840	0.02	0.43

Notes: This table presents the descriptive statistics of the main variables. Panel A reports the number of funds and the corresponding funding amounts. Panel B categorizes these statistics by whether the funds and funding amounts are related to Yangtze River fish or non-Yangtze River fish.

TABLE 2: BASELINE RESULTS

	Number of funds	Funding amount	Publication	Citation
	(1)	(2)	(3)	(4)
YRF × Post	0.105^{***} (0.018)	62.848^{***} (11.503)	0.368^{***} (0.034)	0.238^{***} (0.038)
Species FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Adjusted R^2	0.521	0.349	0.193	0.163
Obs	31240	31240	31240	31240

Notes: This table reports the regression results of the impact of fishing ban on scientific research based on the specification of Equation (1). The table presents the DiD estimation of the impact of fishing regulations on scientific research outcomes, evaluated from both short-term and long-term perspectives. In the short term, the analysis examines two independent variables: the number of funded programs (Column 1) and the amount of funding (Column 2). From a long-term perspective, the analysis examines publications per fund (Column 3) and citations per paper (Column 4). The sample covers the period from 1995 to 2014. *YRF* is a binary indicator that equals one if a fish species belongs to the Yangtze River. *Post* is a binary indicator that equals one in and after 2003. The regression includes fish species fixed effects and year fixed effects. Standard errors in parentheses are clustered at the fish order × year leve. ***, **, and * indicates significance at the 1%, 5%, and 10% level, respectively.

Table 3: Effect of fishing regulation on other scientific outputs and public influence

	Patents	Books	Awards	Public Influence
	(1)	(2)	(3)	(4)
YRF × Post	0.012***	0.003***	0.008***	0.020***
	(0.003)	(0.001)	(0.002)	(0.003)
Species FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Adjusted R^2	0.041	0.050	0.079	0.642
Obs	31240	31240	31240	23415

Notes: This table replaces the dependent variable with other outcomes of the fund, including patents, books, awards (also divided by the number of funds) and news related to fish research. The sample covers the period from 1995 to 2014 for Columns 1-3, and 2000 to 2014 for Column 4. *YRF* is a binary indicator that equals one if a fish species belongs to the Yangtze River. *Post* is a binary indicator that equals one in and after 2003. Standard errors in parentheses are clustered at the fish order × year level. ***, **, and * indicates significance at the 1%, 5%, and 10% level, respectively.

Table 4: Heterogeneous effect on research in Yangtze River Basin institutions

	Number of funds	Funding amount	Publication	Citation
	(1)	(2)	(3)	(4)
YRF × YR Prov × Post	0.077^{***}	47.904^{***}	0.245^{***}	0.159^{***}
	(0.017)	(10.724)	(0.043)	(0.033)
Species FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Province FE	Yes	Yes	Yes	Yes
Adjusted R^2	0.317	0.200	0.140	0.086
Obs	62480	62480	62480	62480

Notes: The table presents the triple difference estimation of the impact of fishing regulations on scientific research outcomes, evaluated from both short-term and long-term perspectives. In the short term, the analysis examines two independent variables: the number of funded programs (Column 1) and the amount of funding (Column 2). From a long-term perspective, the analysis examines publications per fund (Column 3) and citations per paper (Column 4). The sample covers the period from 1995 to 2014. *YRF* is a binary indicator that equals one if a fish species belongs to the Yangtze River. *Post* is a binary indicator that equals one in and after 2003. *YR_Prov* is a binary indicator that equals one if a funded program is hosted by an institution located in one of the provinces within the Yangtze River Basin. The regression includes fish species fixed effects and year fixed effects. Standard errors in parentheses are clustered at the fish order × year level. ***, **, and * indicates significance at the 1%, 5%, and 10% level, respectively.

Table 5: Heterogeneous effect on research related to extinct fish species

	Number of funds	Funding amount	Publication	Citation
	(1)	(2)	(3)	(4)
YRF × Non Extinct × Post	0.148^{***}	86.041^{***}	0.685^{***}	0.400^{**}
	(0.038)	(23.244)	(0.217)	(0.175)
Species FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Adjusted R^2	0.521	0.349	0.193	0.163
Obs	31240	31240	31240	31240

Notes: The table presents the triple difference estimation of the impact of fishing regulations on scientific research outcomes, evaluated from both short-term and long-term perspectives. In the short term, the analysis examines two independent variables: the number of funded programs (Column 1) and the amount of funding (Column 2). From a long-term perspective, the analysis examines publications per fund (Column 3) and citations per paper (Column 4). The sample covers the period from 1995 to 2014. *YRF* is a binary indicator that equals one if a fish species belongs to the Yangtze River. *Post* is a binary indicator that equals one in and after 2003. *Non_Extinct* is a binary indicator that equals one if a fish species is classified as not extinct. The regression includes fish species fixed effects, year fixed effects and Yangze River Province fixed effects. Standard errors in parentheses are clustered at the fish order × year level. ***, **, and * indicates significance at the 1%, 5%, and 10% level, respectively.

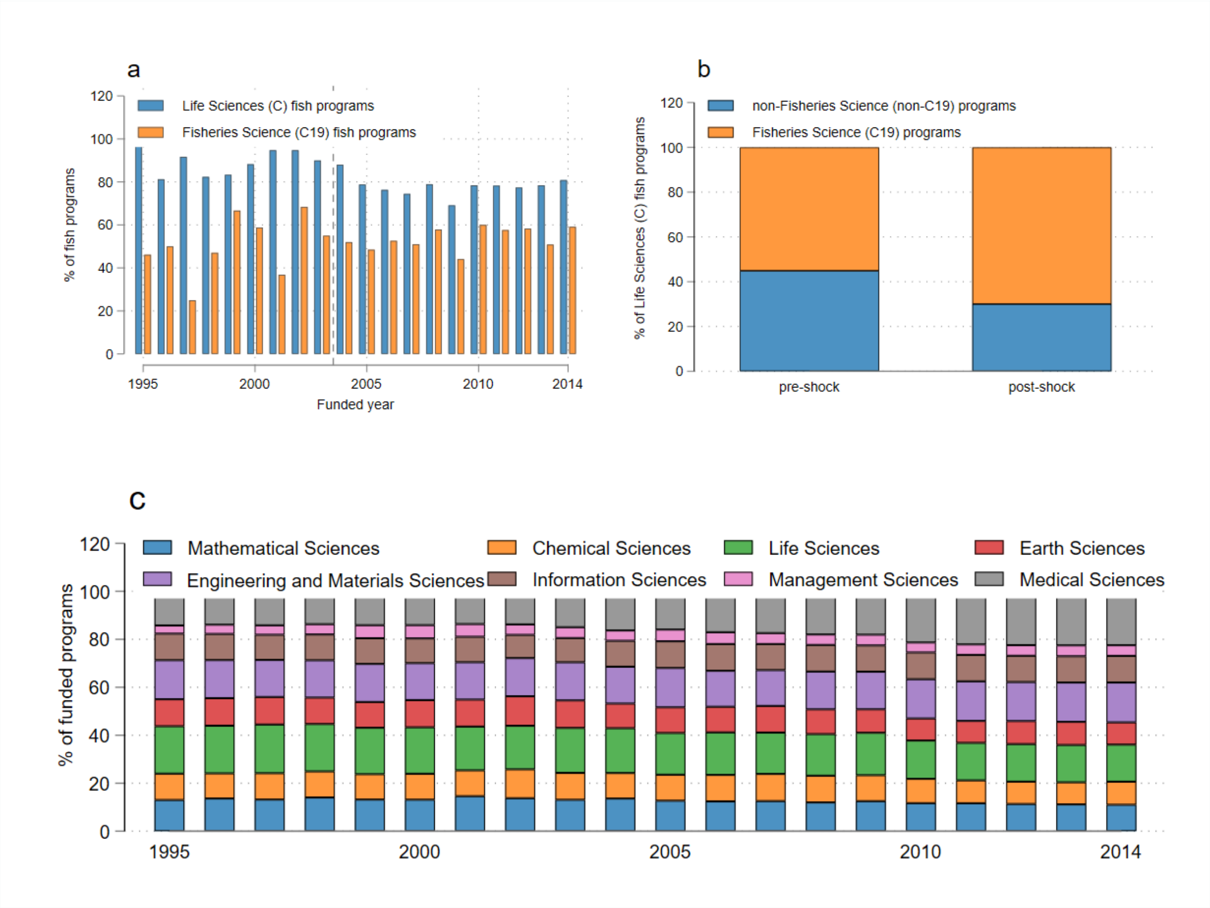
Table 6: Heterogeneous effect on research related to fish species native to upstream of Yangtze River

	Number of funds	Funding amount	Publication	Citation
	(1)	(2)	(3)	(4)
YRF × Non Upstream × Post	0.063^{***}	49.630^{***}	0.068	0.208^{***}
	(0.014)	(10.863)	(0.077)	(0.047)
Species FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Adjusted R^2	0.521	0.349	0.193	0.163
Obs	31240	31240	31240	31240

Notes: The table presents the triple difference estimation of the impact of fishing regulations on scientific research outcomes, evaluated from both short-term and long-term perspectives. In the short term, the analysis examines two independent variables: the number of funded programs (Column 1) and the amount of funding (Column 2). From a long-term perspective, the analysis examines publications per fund (Column 3) and citations per paper (Column 4). The sample covers the period from 1995 to 2014. *YRF* is a binary indicator that equals one if a fish species belongs to the Yangtze River. *Post* is a binary indicator that equals one in and after 2003. *Non_Upstream* is a binary indicator that equals one if a fish species is classified as not endemic to the upstream region of the Yangtze River. The regression includes fish species fixed effects and year fixed effects. Standard errors in parentheses are clustered at the fish order × year level. ***, **, and * indicates significance at the 1%, 5%, and 10% level, respectively.

Appendix

Figure A1: Excluding inter-disciplinary crowding out

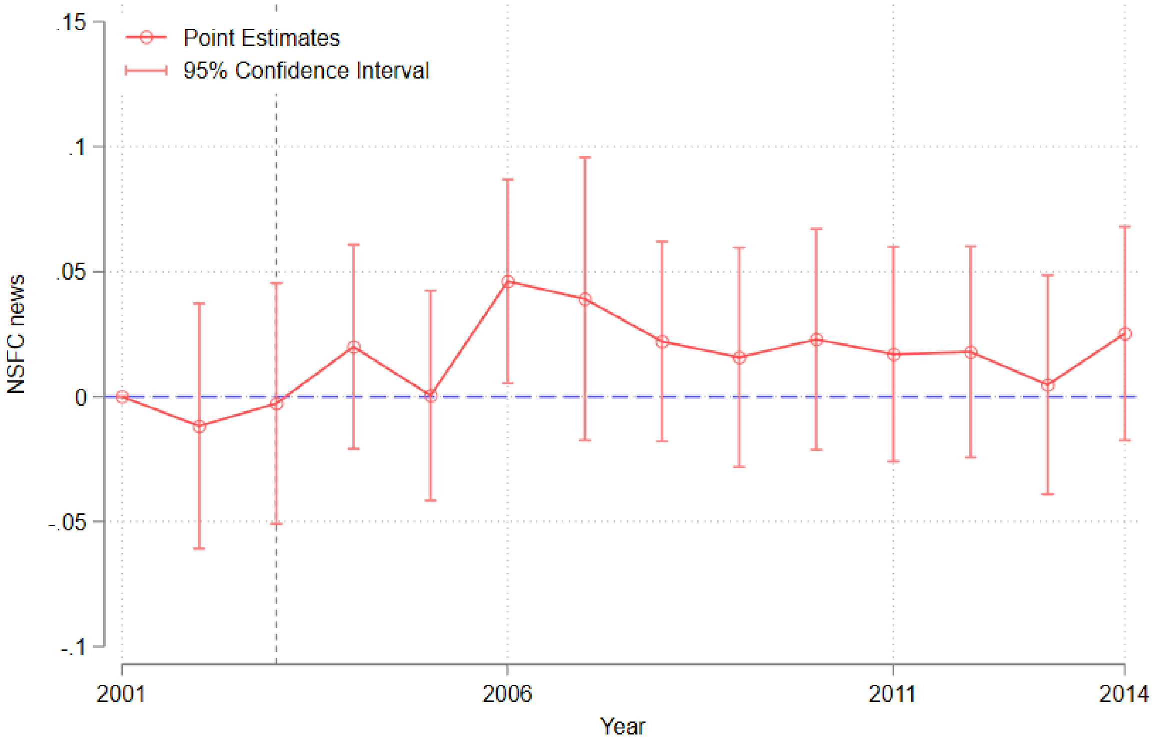


Notes: a, The percentage of fish programs in the discipline of Fisheries Science (code C19) out of all fish programs, and the percentage of fish programs in the discipline of Life Sciences (code C) out of all fish programs. b, The percentage of Fisheries Science fish programs out of all Life Sciences fish programs before and after the fishing ban. c, The percentage of funded programs by each field out of all programs from 1995 to 2014. The fields are: Mathematical Sciences (blue), Chemical Sciences (orange), Life Sciences (green), Earth Sciences (red), Engineering and Materials Sciences (purple), Information Sciences (brown), Management Sciences (pink), and Medical Sciences (gray).

Figure A2: Direct policy support for YRF scientific research

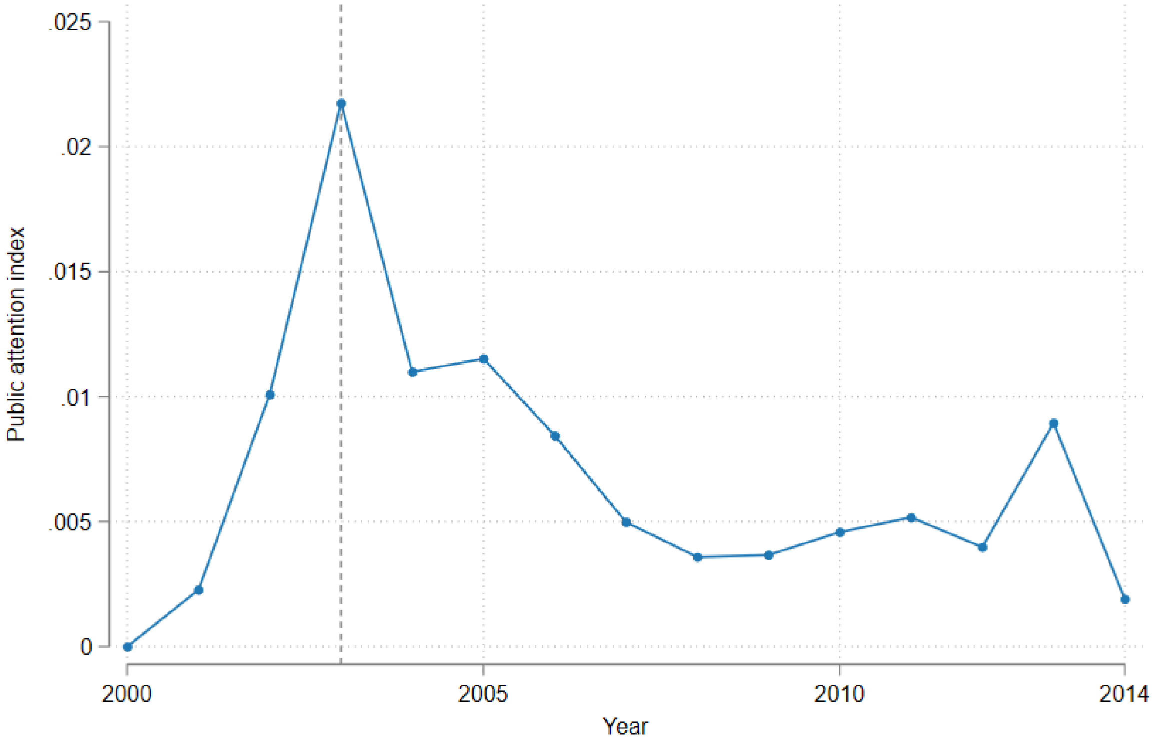
Notes: A word cloud of fishing ban policy documents, where the size of the word indicates its frequency of occurrence. We select the top 30 most frequent words. The fishing ban-related policies were collected from PKULaw.

Figure A3: Direct news for YRF scientific research



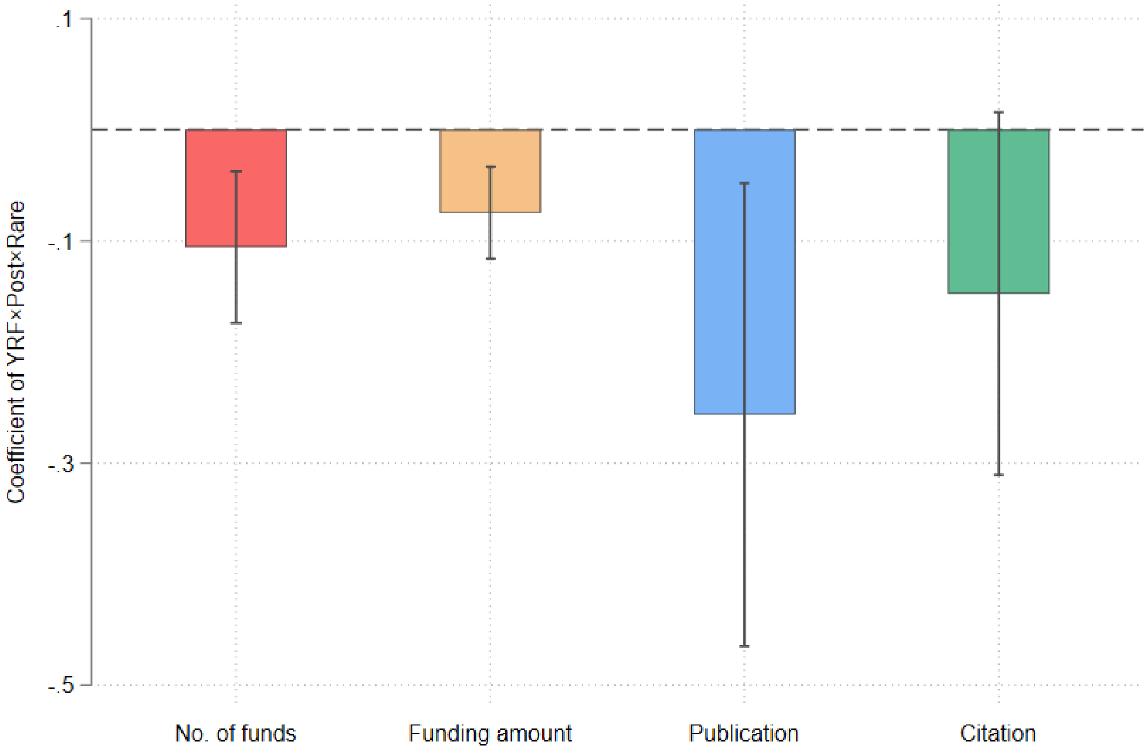
Notes: Changes in support from NSFC towards research on the Yangtze River (see Equation (6)). This is depicted through the estimated changes in the probability of news articles being classified as "Yangtze River research" news. The classification is based on the occurrence of the term "Yangtze River," along with a list of associated research-related terms on the NSFC website (Table A6).

Figure A4: Public attention for YRF scientific research



Notes: Changes in the public's attention regarding the Yangtze River fishing ban. We calculate the Public Attention Index by dividing the number of news reports mentioning the theme "Yangtze River fishing ban" by the total number of news reports mentioning the "Yangtze River" for that particular year. We obtained this data from China National Knowledge Infrastructure (CNKI), and it can be traced back to the year 2000.

Figure A5: Researcher's attention for YRF scientific research



Notes: Heterogeneous effects of fishing ban on research pertaining to rare fish species (see Equation (8) in Methods for details). Rare fish species are classified as vulnerable (VU) or endangered (EN) or critically endangered (CR). The dependent variables are the number of funded programs, funding amount (million RMB), publications per fund, and citations per paper. The regression includes fish species fixed effects and year fixed effects. The standard errors are clustered at the fish order × year level.

Table A1: Subsample statistics$_{F}ishinformation$

Variable	**Sample**	**Number of obs./Category**	**Unique number**
Species	Yangtze	6400	320
	Non-Yangtze	24840	1242
Family	Yangtze	6400	33
	Non-Yangtze	24840	86
Order	Yangtze	6400	16
	Non-Yangtze	24840	33
Habitat	Yangtze	freshwater	303
		saltwater	17
	Non-Yangtze	freshwater	1169
		saltwater	73
Threatened level	Yangtze	not evaluated (NE)	276
		least concern (LC)	2
		vulnerable (VU)	16
		critically endangered (CR)	4
		endangered (EN)	19
		extinct (EX)	1
		extinct in the wild (EW)	2
	Non-Yangtze	not evaluated (NE)	1166
		least concern (LC)	1
		vulnerable (VU)	46
		critically endangered (CR)	3
		endangered (EN)	22
		extinct (EX)	2
		extinct in the wild (EW)	2
Distribution	Yangtze	fish species endemic to the upstream of the Yangtze	46
		other fish in the Yangtze River	274
	Non-Yangtze	non-Yangtze River fish	1242

Notes: This table provides a detailed breakdown of the descriptive statistics for each type of fish, organizing the data by species, family, order (according to the biological classification system), habitat, threatened level, and distribution.

Table A2: Robustness of baseline results

	Number of funds	Funding amount	Publication	Citation
	(1)	(2)	(3)	(4)
YRF × Post	0.104***	62.872***	0.335***	0.218***
	(0.021)	(13.460)	(0.037)	(0.042)
Species FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Family FE×Post	Yes	Yes	Yes	Yes
Adjusted R^2	0.539	0.362	0.213	0.184
Obs	31240	31240	31240	31240

Notes: This table presents additional results as well as robustness checks. Panel A further includes Family × Post fixed effects based on the baseline regression. The sample covers the period from 1995 to 2014. *YRF* is a binary indicator that equals one if a fish species belongs to the Yangtze River. *Post* is a binary indicator that equals one in and after 2003. Standard errors in parentheses are clustered at the fish order × year level. ***, **, and * indicates significance at the 1%, 5%, and 10% level, respectively.

Table A3: Robustness of baseline results

	N=5	N=6	N=7	N=8	Citations after excluding fish species with no funded research
	(1)	(2)	(3)	(4)	(5)
YRF × Post	0.238***	0.280***	0.300***	0.306***	0.610***
	(0.038)	(0.045)	(0.047)	(0.048)	(0.183)
Species FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.163	0.162	0.167	0.155	0.175
Obs	31240	31240	31240	31240	2000

Notes: This table presents additional results as well as robustness checks. Panel B considers the citation counts in the 6th, 7th, and 8th years following the publication of the paper (Columns 1-4) and excludes fish samples that have never been funded by the program (Column 5). The sample covers the period from 1995 to 2014. *YRF* is a binary indicator that equals one if a fish species belongs to the Yangtze River. *Post* is a binary indicator that equals one in and after 2003. Standard errors in parentheses are clustered at the fish order × year level. ***, **, and * indicates significance at the 1%, 5%, and 10% level, respectively.

Table A4: Changes in scientific research on YRF

	Number of funds	Funding amount	Publication	Citation
	(1)	(2)	(3)	(4)
Post	0.113***	67.061***	0.415***	0.262***
	(0.019)	(12.076)	(0.038)	(0.041)
Species FE	Yes	Yes	Yes	Yes
Adjusted R^2	0.542	0.361	0.213	0.157
Obs	6400	6400	6400	6400

Notes: This table shows the changes in scientific research on Yangtze River fish after the fishing ban. The regressions restrict the sample to Yangtze River fish. Throughout the analysis, fish species fixed effects are controlled for, and the dependent variables encompass four key indicators of scientific research: the number of funded programs (Column 1), the amount of funding (Column 2), publications per fund (Column 3), and citations per paper (Column 4). The variable *Post* is assigned a value of 1 if the year is 2003 or later and 0 otherwise. Standard errors in parentheses are clustered at the fish order × year level. ***, **, and * indicates significance at the 1%, 5%, and 10% level, respectively.

TABLE A5: CHANGES IN SCIENTIFIC RESEARCH ON NON-YRF

	Number of funds	Funding amount	Publication	Citation
	(1)	(2)	(3)	(4)
Post	0.008***	4.214***	0.047***	0.024***
	(0.002)	(1.018)	(0.008)	(0.005)
Species FE	Yes	Yes	Yes	Yes
Adjusted R^2	0.296	0.206	0.125	0.156
Obs	24840	24840	24840	24840

Notes: This table shows the changes in scientific research on non-Yangtze River fish after the fishing ban. The regressions restrict the sample to non-Yangtze River fish. Throughout the analysis, fish species fixed effects are controlled for, and the dependent variables encompass four key indicators of scientific research: the number of funded programs (Column 1), the amount of funding (Column 2), publications per fund (Column 3), and citations per paper (Column 4). The variable *Post* is assigned a value of 1 if the year is 2003 or later and 0 otherwise. Standard errors in parentheses are clustered at the fish order × year level. ***, **, and * indicates significance at the 1%, 5%, and 10% level, respectively.

Table A6: Excluding programs related to Yangtze River and fish protection

	Excluding YR related programs	Excluding protection related programs	X=6	X=7	X=8	X=9	X=10
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
YRF × Post	0.095^{***}	0.081^{***}	0.077^{***}	0.079^{***}	0.082^{***}	0.082^{***}	0.087^{***}
	(0.016)	(0.015)	(0.015)	(0.015)	(0.015)	(0.015)	(0.016)
Species FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.521	0.520	0.506	0.513	0.519	0.522	0.522
Obs	31240	31240	31240	31240	31240	31240	31240

Notes: This table presents the regression results at the fish-year level after excluding programs related to the "Yangtze River" or "fish protection." Column 1 shows the regression results after removing programs related to the "Yangtze River," defined as programs with the term "Yangtze" in their titles, abstracts, or keywords. Column 2 shows the regression results after removing programs related to "fish protection," defined as programs with the term "protection" in their titles, abstracts, or keywords. Columns 3 to 7 use a prominent large language model (GPT 4o) to determine whether a program is related to "fish protection." The sample covers the period from 1995 to 2014. *YRF* is a binary indicator that equals one if a fish species belongs to the Yangtze River. *Post* is a binary indicator that equals one in and after 2003. Standard errors in parentheses are clustered at the fish order × year level. ***, **, and * indicates significance at the 1%, 5%, and 10% level, respectively.

Table A7: Heterogeneous effect on research related to rare fish species

	Number of funds	Funding amount	Publication	Citation
	(1)	(2)	(3)	(4)
YRF × Rare × Post	-0.106***	-0.075***	-0.256**	-0.148*
	(0.035)	(0.021)	(0.106)	(0.083)
Species FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Adjusted R^2	0.521	0.349	0.194	0.163
Obs	31240	31240	31240	31240

Notes: The table presents the triple difference estimation of the impact of fishing regulations on scientific research outcomes, evaluated from both short-term and long-term perspectives. In the short term, the analysis examines two independent variables: the number of funded programs (Column 1) and the amount of funding (Column 2). From a long-term perspective, the analysis examines publications per fund (Column 3) and citations per paper (Column 4). The sample covers the period from 1995 to 2014. *YRF* is a binary indicator that equals one if a fish species belongs to the Yangtze River. *Post* is a binary indicator that equals one in and after 2003. *Rare* is a binary indicator that equals one if a fish species is classified as vulnerable or endangered or critically endangered. The regression includes fish species fixed effects and year fixed effects. Standard errors in parentheses are clustered at the fish order × year level. ***, **, and * indicates significance at the 1%, 5%, and 10% level, respectively.

TABLE A8: LIST OF VOCABULARY RELATED TO SCIENTIFIC RESEARCH

Chinese words	**English translation**
研究	Research
科研	Scientific research
实验	Experiment
试验	Test
创新	Innovation
突破	Breakthrough
论文	Paper
专利	Patent
学术	Academic
理论	Theory

Notes: This table presents a set of vocabulary related to scientific research. We use this vocabulary to determine whether the news on the NSFC website (Equation (6)) and the impact of fish research (Equation (7)) are research-related.