

Community scientists provide knowledge and public education and help enforce environmental regulations in social-ecological systems

Corresponding Author: Mr Ryan O'Connor

This file contains all editorial decision letters in order by version, followed by all author rebuttals in order by version.

Version 0:

Decision Letter:

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Dear Mr O'Connor,

Your manuscript titled "Community Scientists Fill Gaps in Knowledge Generation, Education, and Enforcement in Social-Ecological Systems" has now been seen by 2 reviewers, and we include their comments at the end of this message. They find your work of interest, but some important points are raised. We are interested in the possibility of publishing your study in Communications Earth & Environment but would like to consider your responses to these concerns and assess a revised manuscript before we make a final decision on publication.

We therefore invite you to revise and resubmit your manuscript, along with a point-by-point response that takes into account the points raised. Please highlight all changes in the manuscript text file.

For publication in Communications Earth & Environment, we request that you (1) provide the research context and outline your method in detail, clearly define all concepts, including the definition of community scientists, and clarify the role of the adopted framework and its modification (2) expand your discussion to account for community benefits.

Please submit your point-by-point responses as a separate file, distinct from your cover letter where you can add responses to the Editors' comments that you do not want to be made available to the reviewers. Word files are preferred. We recommend that any figures, tables or graphs that are included in the response to reviewers are also included in the main article or Supplementary Information.

We are committed to providing a fair and constructive peer-review process. Please don't hesitate to contact us if you wish to discuss the revision in more detail.

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We hope to receive your revised paper within six weeks; please let us know if you aren't able to submit it within this time so that we can discuss how best to proceed. If we don't hear from you, and the revision process takes significantly longer, we may close your file. In this event, we will still be happy to reconsider your paper at a later date, as long as nothing similar has been accepted for publication at Communications Earth & Environment or published elsewhere in the meantime.

Please do not hesitate to contact us if you have any questions or would like to discuss these revisions further. We look forward to seeing the revised manuscript and thank you for the opportunity to review your work.

Best regards,

Edmond Totin, PhD
Editorial Board Member
Communications Earth & Environment
orcid.org/0000-0003-33776190

Martina Grecequet, PhD
Senior Editor
Communications Earth & Environment

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- If a dataset has a Digital Object Identifier (DOI) as its unique identifier, we strongly encourage including this in the Reference list and citing the dataset in the Data Availability Statement.

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Please refer to our data policies at <http://www.nature.com/authors/policies/availability.html>.

REVIEWER COMMENTS:

Reviewer #1 (Remarks to the Author):

Thank you for this opportunity to review your paper. I really enjoyed reading it. Community science as you describe it here is undoubtedly under-researched, despite being a major influence in environmental and natural resource governance structures and processes. More research is certainly needed on the sorts of “grass roots” governance you describe in your study. This paper can potentially make a significant contribution to that literature, not to mention benefit the stakeholders and rightsholders of your particular research context. I found your descriptions of community enforcement especially interesting.

However, I believe there are some steps that can be taken to improve your paper, included below, which I hope you find helpful.

- I think you could be more clear in how you are defining and applying your concepts. For example, the discussion of boundary objects in the introduction does not seem to add much to the paper, nor am I sure I agree completely with how you have defined them. I wonder if concepts such as boundary organizations or bridging organizations might be more helpful. Similarly, your definition of community scientists seems to exclude what I would normally consider to be community scientists, which would be scientists, including professionals, who work primarily with communities and in the communities' interests. I am not clear on how your definition overlaps with and is distinct from citizen scientists and science, which has its own corresponding literature. In your results section, you also frequently refer to institutional capacity gaps, but you seem to diverge from how I would typically understand social institutions. This would benefit from further clarity, and perhaps some description in the introduction as well.

- Elinor Ostrom's SES framework features prominently at the start of your paper, but I think this inclusion could be expanded on somewhat. I am a little unclear on the role the framework played in your study. Did it inform your research question, participant sampling, or interview questions? How did your results and analyses lead to your modifications? For instance, I am uncertain what the “knowledge generation” arrows indicate. I would also typically expect to see these kinds of modifications to a framework, informed by your own analyses(?), to come at the end of the paper, rather than the beginning.

- Overall, I think some modifications to the organization of the paper may help improve clarity for the reader. For example, in your results section you could consider, for each of the three boundary spanning roles, described the capacity gaps first, and then the ways in which community scientists fill those gaps, instead of vice versa. Ending the paper with the methods section also strikes me as highly unusual for this kind of work, although I understand that is the norm for the journal. Nonetheless, a few more details of your study and research context presented before the results may be beneficial. In fact, I am a little puzzled at the lack of information on research context presented anywhere in your paper. Was this a condition for gaining access to your participants? This lack of information on the marine mammals in question, the geographic location within California, or the government agencies and communities involved could make it a little difficult for others to interpret your results and apply them to their own work. These kinds of details are often presented in studies without breaking anonymity or confidentiality. For a qualitative study like this, this lack may also raise some trustworthiness (or validity, or rigour, etc.) concerns as well. Your positionality and the influences of the research context on your analyses and results are somewhat absent from the paper.

Thank you again for the opportunity to review your work. This article is highly relevant to the journal themes and has strong novelty and importance, and I think it can make an excellent contribution.

Reviewer #2 (Remarks to the Author):

I found the paper to be very interesting and provided important insights. My comments are more about the writing and pitch, and not about the merit of the contribution. They come from someone who studies socioecological systems, alongside community scientists, from an ecological perspective. So, likely a bit removed from the expertise of the authorship team, but someone who is interested in the topic and contributions of the paper.

Line 31-71: as someone who is slightly beyond the area of expertise of the authors, I find the first part of the intro very jargon-filled and a bit difficult to digest and/or engage with. I wonder if the same would be true for many readers of this journal. Is there a way to open the paper with a bit more context as to why I, someone who studies socio-ecological systems or care about their conservation, should care about this paper? I follow the concept and usefulness of the question being asked in this paper, the intro just doesn't seem super broadly applicable or engaging. Think of the community scientists, themselves? This paper is about them and, likely, not many of them would be able to engage with it. While, in contrast, I find the results to be very approachable and relatable.

Line 93-95: This is the only explicit mention of Indigenous knowledge or peoples and I think there needs to be some thought and care put into how and whether Indigenous Peoples are even mentioned in this paper. I am uncomfortable with how “community scientists” are defined as well as the “benefits” that community scientists offer science if you lump in Indigenous peoples. So, I would suggest either having a bit of a nuanced discussion about why or why not everyone is considered the same, or just stating somewhere that you are not going to discuss Indigenous stewards in this paper... because it is a different thing (to have the right and responsibility to steward the land, compared to volunteering for science projects that benefit science and scientist). Are you hoping the reader assumes Indigenous Peoples are included in this paper, or excluded, or neither?

Line 136: Why the focus on government officials only? SES can include many other “governing bodies” or “boundaries” that need spanning. Just wondering if there could be a bit more explanation of this earlier on in the paper – why is this an important case study/context to analyze?

Line 326: the discussion about knowledge generation places most emphasis on benefits to government officials (as they

were the ones who lacked capacity and use the data) – could you add a sentence or two related to why this is important beyond the government officials? Perhaps for the community scientists? The discussion headings are all about institutional insufficiencies, but what about community benefits? I think this can be applied to other areas of the paper, too. Especially since the paper talks about the value of community scientists to knowledge generation, education, and impact of science.

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Version 1:

Decision Letter:

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Dear Mr O'Connor,

Your manuscript titled "Community Scientists Fill Gaps in Knowledge Generation, Education, and Enforcement in Social-Ecological Systems" has now been seen by our reviewers, whose comments appear below. In light of their advice we are delighted to say that we are happy, in principle, to publish a suitably revised version in Communications Earth & Environment.

We therefore invite you to edit your manuscript to comply with our format requirements and to maximise the accessibility and therefore the impact of your work.

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We hope to hear from you within two weeks; please let us know if you need more time.

Best regards,

Edmond Totin, PhD
Editorial Board Member
Communications Earth & Environment

Martina Grecequet, PhD
Senior Editor,
Communications Earth & Environment
@CommsEarth

REVIEWERS' COMMENTS:

Reviewer #1 (Remarks to the Author):

Thank you. My comments have been sufficiently addressed. I look forward to seeing the published paper.

Reviewer #2 (Remarks to the Author):

I am satisfied with the changes to the manuscript - it is clear in the responses and edits that the authors took both reviewers comments to heart and made appropriate changes to address them.

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Community Scientists Fill Gaps in Knowledge Generation, Education, and Enforcement in Social-Ecological Systems

Submission ID COMMSENV-24-2057-T

Submitted to *Nature Communications: Earth and Environment*

Response to Reviewers - **Due November 14, 2024**

Note: Line numbers referenced in comments refer to the line number of the original submission

#	Reviewer's Comment	Authors' Response
Reviewer #1		
1.0	Thank you for this opportunity to review your paper. I really enjoyed reading it. Community science as you describe it here is undoubtedly under-researched, despite being a major influence in environmental and natural resource governance structures and processes. More research is certainly needed on the sorts of "grass roots" governance you describe in your study. This paper can potentially make a significant contribution to that literature, not to mention benefit the stakeholders and rightsholders of your particular research context. I found your descriptions of community enforcement especially interesting.	Thank you for your kind words and interest in this important topic.
1.1	I think you could be more clear in how you are defining and applying your concepts. For example, the discussion of boundary objects in the introduction does not seem to add much to the paper, nor am I sure I agree completely with how you have defined them. I wonder if concepts such as boundary organizations or bridging organizations might be more helpful. Similarly, your definition of community scientists seems to exclude what I would normally consider to be community scientists, which would be scientists, including professionals, who work primarily with communities and in the communities' interests. I am not clear on how your definition overlaps with and is distinct from citizen scientists and science, which has its own corresponding literature. In your results section, you also frequently refer to institutional capacity gaps, but you seem to diverge	Regarding the definition of boundary objects, we agree that clarifying our discussion around boundary organizations as opposed to boundary objects is more effective and helpful to contextualize and situate the paper. We adjusted this section of the introduction to use and operationalize the term "boundary organization" as opposed to "boundary object" and cited additional literature specifically in boundary organization theory to align with this revision. Regarding the question of how "community scientists" are distinct from "citizen scientists" and the literature describing them, we would like to clarify that our use of "community scientists" is meant to refer to what has traditionally been referred to as "citizen science." However, we recognize that "citizen science" can be an anachronistic and exclusionary term and that many institutions, organizations, and scholars recently have

	from how I would typically understand social institutions. This would benefit from further clarity, and perhaps some description in the introduction as well.	been moving away from this term. Ellwood and colleagues (2023) provide an excellent summary of the rationale behind this shift in language and emphasize the growing acceptance of the term “community science” in its place (see https://doi.org/10.1016/j.tree.2023.03.003). We appreciate the reviewer noting this lack of clarity; we added text and a reference to Ellwood et al. (2023) to better contextualize what we mean by “community science” and why we use this term. In reference to the related comment regarding professional scientists, this study intentionally excludes professional scientists who work in communities (we would typically refer to them as “community-engaged scientists”). The processes on which this study focuses occur when community members voluntarily engage in science/scientific processes. Regarding the discussion of institutional capacity gaps, we agree that this narrative could benefit from more clarity and a description in the introduction. We, therefore, added text to the introduction and added relevant citations to contextualize the paper more effectively in the social institutions and commons theory literature. In the new text, we briefly explain that the capacity gaps we investigated result from a range of circumstances common across various social institutions. However, the findings that boundary spanning happened in response to institutional gaps was not an <i>a priori</i> assumption or observation, but rather a result. Because of this, we kept the mention of it very brief in the Introduction, allowing for greater emphasis in the results and discussion. We also clarified our description of institutional capacity gaps in the results and discussion and made revisions that we believe help provide clarity as to how we view institutional capacity gaps. These include consistency of language around what sorts of limitations are experienced, as well as more clarity around our definition of institutions and the fact that this particular case examines government agencies as the institutions.
1.2	Elinor Ostrom’s SES framework features prominently at the start of your paper, but I think this inclusion could be expanded on somewhat. I am a little unclear on the role the framework played in your study. Did it inform your research	We agree that we could more effectively explain the influence of Ostrom’s SES framework on our analysis throughout the manuscript. This framework provided a map on which we could identify and position the gaps being addressed by the boundary spanning processes. We

	question, participant sampling, or interview questions? How did your results and analyses lead to your modifications? For instance, I am uncertain what the “knowledge generation” arrows indicate. I would also typically expect to see these kinds of modifications to a framework, informed by your own analyses(?), to come at the end of the paper, rather than the beginning	added language in the introduction to clarify this connection and also added detail in the results and discussion to strengthen the connections between the narrative and the SES framework. Regarding the uncertainty around the “knowledge generation” arrows, we agree that this was not well-explained in the original manuscript. We added text referencing these arrows in section 2.1 of the results, as well as to the caption of this figure and the individual results subsections briefly explaining the arrows for each of the 3 processes. Regarding the placement of Fig. 1, we agree this traditionally would come toward the end of the paper, as it was informed by our analyses. We moved this figure to the beginning of the results section, as we believe it is useful in the context of the introduction and is referenced throughout each of the results subsections.
1.3	Overall, I think some modifications to the organization of the paper may help improve clarity for the reader. For example, in your results section you could consider, for each of the three boundary spanning roles, described the capacity gaps first, and then the ways in which community scientists fill those gaps, instead of vice versa. Ending the paper with the methods section also strikes me as highly unusual for this kind of work, although I understand that is the norm for the journal. Nonetheless, a few more details of your study and research context presented before the results may be beneficial. In fact, I am a little puzzled at the lack of information on research context presented anywhere in your paper. Was this a condition for gaining access to your participants? This lack of information on the marine mammals in question, the geographic location within California, or the government agencies and communities involved could make it a little difficult for others to interpret your results and apply them to their own work. These kinds of details are often presented in studies without breaking anonymity or confidentiality. For a qualitative study like this, this lack may also raise some trustworthiness (or validity, or rigour, etc.) concerns as well. Your positionality and the influences of the research	Thank you for these insights into how we could improve the paper’s readability. Regarding the ordering of the results sections, we agree that arranging the capacity limitations prior to the boundary spanning behaviors is a logical and comprehensible organization. We made this switch in each of the 3 results subsections and made minor adjustments to the text to ensure that the narrative matches this organization. Regarding the arrangement of the methods section, we followed the journal guidelines and examples of previously published articles in this journal when placing the methods section at the end. That said, we agree that some additional context as to the methods used could help strengthen and contextualize the narrative. We made minor additions throughout the manuscript to account for this (particularly at the end of the introduction), but were careful to not add strictly methodological text in sections other than the methods. Regarding the research context, we appreciate you highlighting the impact of our lack of particular details of the system. A condition of our IRB approval and access to interview participants (particularly the government officials) was to provide total anonymity and

	context on your analyses and results are somewhat absent from the paper	confidentiality of both personal and place identities, particularly as sensitive policy processes are actively underway in this system. We did our best to contextualize the important characteristics of each, while providing sufficient detail, particularly in the study location section, to allow readers to understand the context in which we conducted the study. In the manuscript, we made minor additions to provide more details in line with these suggestions and added language to clarify that we made these decisions in line with the norms and expectations of qualitative human subjects research. As this is a human-subjects study that directly investigates the behaviors of the research participants, we have been cautious to limit any identifiable information. Regarding the lack of our positionality, we very much appreciate you highlighting this omission. We added a positionality statement to the methods section to provide greater context as to how our own identities and the research context has influenced our analyses.
Reviewer #2		
2.0	I found the paper to be very interesting and provided important insights. My comments are more about the writing and pitch, and not about the merit of the contribution. They come from someone who studies socioecological systems, alongside community scientists, from an ecological perspective. So, likely a bit removed from the expertise of the authorship team, but someone who is interested in the topic and contributions of the paper.	Thank you very much for sharing your perspective and helping us improve our manuscript. We note below how we have addressed specific comments; we believe these changes have strengthened the paper substantially.
2.1	Line 31-71: as someone who is slightly beyond the area of expertise of the authors, I find the first part of the intro very jargon-filled and a bit difficult to digest and/or engage with. I wonder if the same would be true for many readers of this journal. Is there a way to open the paper with a bit more context as to why I, someone who studies socio-ecological systems or care about their conservation, should care about this paper? I follow the concept and usefulness of the question being asked in this paper, the intro just doesn't seem super broadly applicable or engaging. Think of the community scientists, themselves? This paper is	Thank you for highlighting the opportunity to reduce jargon and make our writing more appropriate for a broader audience. We agree that the referenced section could be simplified in its language; we made several revisions throughout the introductory paragraphs to reduce jargon, increase conciseness, and simplify the language. We also expanded on the last sentence in the referenced section ("This understanding can better inform...") to provide a clearer argument for why SES researchers should care about these processes and to make it more broadly applicable. We made minor revisions throughout the rest of the introduction to increase the generalizability and relevance of the

	about them and, likely, not many of them would be able to engage with it. While, in contrast, I find the results to be very approachable and relatable.	manuscript for a broader audience. We are very glad to hear that the results are approachable and relatable; we appreciate this comment.
2.2	Line 93-95: This is the only explicit mention of Indigenous knowledge or peoples and I think there needs to be some thought and care put into how and whether Indigenous Peoples are even mentioned in this paper. I am uncomfortable with how “community scientists” are defined as well as the “benefits” that community scientists offer science if you lump in Indigenous peoples. So, I would suggest either having a bit of a nuanced discussion about why or why not everyone is considered the same, or just stating somewhere that you are not going to discuss Indigenous stewards in this paper... because it is a different thing (to have the right and responsibility to steward the land, compared to volunteering for science projects that benefit science and scientist). Are you hoping the reader assumes Indigenous Peoples are included in this paper, or excluded, or neither?	Thank you for highlighting this important point - we agree that the discussion of Indigenous peoples is insufficient. Our intention was to acknowledge that Indigenous Ecological Knowledge has a vital place in this general discourse. However, our research did not engage directly with Indigenous peoples and so, in our results and discussion, we did not feel it was appropriate to include discussion of Indigenous Ecological Knowledge in the context of our analysis. We agree with your suggestion to state that Indigenous knowledge is a related, but distinct, subject, which we do not address in this paper but that is in need of greater study. We removed the mention of Indigenous Ecological Knowledge from the reference section of the manuscript and added a brief explanation of the above.
2.3	Line 136: Why the focus on government officials only? SES can include many other “governing bodies” or “boundaries” that need spanning. Just wondering if there could be a bit more explanation of this earlier on in the paper – why is this an important case study/context to analyze?	We focused on government officials as accessible representatives of governing bodies and other governance boundaries in our study system. We agree that many other entities could have been investigated in this context; however, the group of community scientists we interviewed had regular interactions with three specific government agencies, and the officials on whom we focused were the public-facing representatives of those agencies. Importantly, they were also the officials who engaged in the most regular interaction with the community scientists. We believe that this focus provides an extrinsically interesting case as this style of interaction with a few specific government representatives is not unique to this system and the insights are therefore translatable. We discuss this in the paper’s methods section; however, we agree that the introduction could benefit from a discussion of these points. We, therefore, added text to the referenced section to better contextualize this decision.
2.4	Line 326: the discussion about knowledge generation places most emphasis on benefits to government officials (as they were the ones who	Thank you for highlighting this opportunity to expand our discussion beyond the government officials. We added a few sentences at the end of the referenced paragraph and

	lacked capacity and use the data) – could you add a sentence or two related to why this is important beyond the government officials? Perhaps for the community scientists? The discussion headings are all about institutional insufficiencies, but what about community benefits? I think this can be applied to other areas of the paper, too. Especially since the paper talks about the value of community scientists to knowledge generation, education, and impact of science.	the other paragraphs in this section that (1) contextualizes the benefits reported in the interview data by the community scientists and (2) details benefits that have been established in the literature and are referenced earlier in the manuscript. We also made minor additions and adjustments to existing wording throughout the manuscript, as we agree that this context could be applied throughout to better emphasize the mutual benefits of these processes.
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Community scientists provide knowledge and public education and help enforce environmental regulations in social-ecological systems

Submission ID COMMSENV-24-2057-T
Submitted to *Nature Communications: Earth and Environment*
Response to Reviewers - **Due January 16, 2025**

#	Comment	Authors' Response
Editorial Requests		
0.1	Please review our specific editorial comments and requests regarding your manuscript in the attached "Editorial Requests Table". *****Please take care to match our formatting and policy requirements. We will check revised manuscript and return manuscripts that do not comply. Such requests will lead to delays. ***** Please outline your response to each request in the right hand column. Please upload the completed table with your manuscript files as a Related Manuscript file.	Thank you for providing these detailed editorial comments and instructions. We have made minor formatting and editorial revisions to accommodate these requests, which do not substantively change the manuscript itself. Specific responses are included in the "editorial Requests Table," which we have submitted through the manuscript tracking system.
Reviewer #1		
1.1	Thank you. My comments have been sufficiently addressed. I look forward to seeing the published paper.	No response needed.
Reviewer #2		
2.1	I am satisfied with the changes to the manuscript - it is clear in the responses and edits that the authors took both reviewers' comments to heart and made appropriate changes to address them.	No response needed.