Vulnerable fishes, inattentive humans

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A comprehensive analysis of 2048 species of reef fishes reveals the shortcomings of human interest: The most at-risk species generally receive the least attention.

Near the end of summer 1962, Robert Pierre André Sténuit became the world's first aquanaut. For 24 consecutive hours, he lived off the coast of the French Riviera in a cylindrical submersible, 60 m beneath the surface of the Mediterranean. Less than a year later, Jacques Cousteau shattered Sténuit's record, residing in a small "village" with five other aquanauts on the Sudanian Shab Rumi reef, for 30 days. Since then, about 700 people have earned the title aquanaut, among them a variety of astronauts as well as ocean conservation luminaries such as Sylvia Earle.

As impressive as these expeditions are, they simultaneously administer a sobering reality. When it comes to life underwater, we operate in a veritable vacuum of information. Humanity's direct experience with marine life is trifling: 111 days—the longest anyone has spent continuously submerged according to Guinness World Records—is less than 0.5% of a typical human lifetime. And yet, these slivers of time underwater pack a punch. They have dramatically expanded knowledge, inspired millions, and deepened appreciation for the complexity, fragility, resilience, and mystery of life below the surface of the sea.

Further expanding such attention to and care for aquatic life—its ecosystems, species, populations, cultures (*1*), and individuals (*2*)—is urgently needed as a bulwark against looming devastation. Industrial encroachment into the oceans began centuries ago and, with a few notable exceptions (e.g., the International Whaling Commission's moratorium spelling the end of industrial whaling), has increased steadily since. Compounded by a litany of other threats including habitat loss and fragmentation, warming, acidification, diminished oxygenation from climate change, and an array of pollutants such as plastics and noise (*3*), the loss of marine life is likely to accelerate (*4*); likely, that is, without well-placed intervention.

In this issue of *Science Advances*, Mouquet *et al.* (*5*) leverage large data sets from real-time online sources to ask the crucial question: To what degree is global attention trained on those marine species at greatest risk from anthropogenic threats? For international environmental protection to be effective, both a foundation of scientific knowledge and broad public engagement are critical. Without either one, policy responses will be weak, unpopular, or nonexistent. And, given the relatively low baseline of knowledge about marine species (*4*) and our paucity of direct experience with marine life, assessing attention, or lack thereof, to at-risk marine species is of particular value for coordinating collective ocean conservation action.

Focusing on 2408 species of reef fishes, Mouquet *et al.* operationalize global attention with two cleverly constructed indicator variables. First, to capture scientific interest, they aggregated data from Scopus, Google, Web of Science, FishBase (*6*), and the National Center for Biotechnology Information to create a composite measure of research effort. Second, they gathered engagement metrics for each species from an array of freely available online resources: X [formerly Twitter (tweets, retweets, and likes)], Flickr (number of images), and Wikipedia (page views in 10 languages) and created a composite measure of global public attention. These two measures of human interest (research effort and public attention) were correlated ($r = 0.65$) and varied substantially by species. Some fish species received a great deal of attention across the board and others attracted little (Fig. 1).

The authors then used a variety of species-level characteristics—attributes and human use indicators for each species—to predict variability in each composite measure. By far, the strongest predictor of interest was a species' geographic range. Wide-ranging species generally attracted greater interest, explaining 50% of the variability in research effort and 47% of the variability in public attention. After range, however, the main determinants of interest diverged. The second and third most important predictors of research effort were use in fisheries and aquaculture, accounting for 12 and 8% of the variability in research effort, respectively. The second and third most important predictors of public attention, in contrast, were a quantitative indicator of human aesthetic preference and use in the aquarium trade, accounting for 21 and 13% of the variability in public attention, respectively.

However, the species exposed to the greatest anthropogenic threats did not tend to attract higher research effort nor did they tend to attract higher public attention. Two independent analyses found the opposite pattern. Species classified by the International Union for Conservation of Nature (IUCN) red list as "threatened" received significantly less research effort and public attention than species classified as "least concern." Similarly, species predicted to be most vulnerable in a climate risk vulnerability index received significantly less research effort and public attention than species predicted to be less vulnerable to climate change. In other words, those species in the most need of coordinated conservation effort received the least amount of attention needed to support such efforts.

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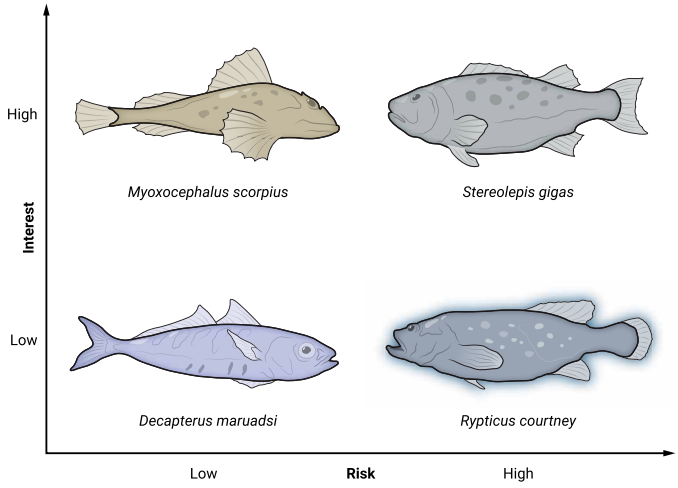

Fig. 1. The ones who need the most often receive the least. Four species of reef fishes exemplify a range of outcomes with respect to attention from the scientific community and global public: Japanese scad (*Decapterus maruadsi*) and shorthorn sculpin (*Myoxocephalus scorpius*) are both at low risk and they receive low and high interest, respectively. The giant sea bass (*Stereolepis gigas*) is at high risk but also attracts a relatively high amount of attention. Most alarmingly, Socorran soapfish (*Rypticus courtney*) are at high risk from anthropogenic threats but receive very little attention from the scientific community or the global public. Illustration credit: Austin Fisher/*Science Advances*.

TAKING ACTION

While it is impossible to expand a species range from narrow to large (the main predictor of high global interest), this research does suggest several research, policy, and public engagement interventions to deploy and explore.

As the authors note, particularly low hanging fruit are those species labeled by the IUCN as "data deficient" or "not evaluated" but that have already attracted a substantial amount of scientific investigation as indicated by the composite research effort variable. While species classified as data deficient or not evaluated tend to receive less research interest than species classified as least concern, examples exist of numerous species within each classification (data deficient and not evaluated) that have an apparently substantial body of research. Moreover, many of the data deficient or not evaluated species have more research on them than some of the species classified as threatened.

By identifying reef species at the nexus of a relatively high existing research effort and classified as data deficient or not evaluated, this research (and similar future research) helps triangulate gaps in conservation assessment. Using this approach researchers can prioritize which species to fast-track for assessment in the near future, with the strong possibility that some of these species may already be eligible for classification as threatened or least concern.

Modeling both scientific and public attention alongside species-level characteristics and vulnerabilities, Mouquet *et al*. set the stage for in-depth inquiry into the causal dynamics between the production of scientific knowledge, public attention, and, crucially, conservation outcomes. The data generated shows, for example, that while reef species classified by the IUCN as threatened tended to receive less attention than species within the other classifications, a handful of threatened reef fish species have attracted disproportionately high attention across both dimensions of interest. Subsequent cultural, historical, or sociological analyses of these pattern-breaking species could illuminate what factors may account for their differential trajectory and whether such factors could be generalized and replicated in other species or other regions.

Expanding the methodology developed by Mouquet *et al.* to additional taxa, geographic regions, and across time will thus enrich our understanding of human interest-conservation dynamics and may suggest innovative pathways to boost conservation support and action. For instance, while the present research found that vulnerable reef fishes tend to inspire little regard—both scientifically and in their appeal to the public—the same may not be true of human attention to other taxa. The birding community is notorious for their all-consuming passion, including zeal for rare and unconventionally beautiful species.

Indeed, what motivates many birders is precisely the rarity of a species and its attendant vulnerability. Aesthetics are relegated to a position of secondary importance. The five species of Kiwi birds found in New Zealand, for instance, are not conventionally attractive birds, but nonetheless they are beloved icons of the nation and sought out by international birding enthusiasts, making their conservation a concern for many around the globe.

Could vulnerable, rare reef fishes experience the same kind of concern and enthusiasm? What role might science, the arts, social media, public outreach campaigns, responsible and respectful tourism (*7*), governments, and funding bodies play in ushering in such a shift in values? The answers to these questions are now within reach more than ever because of this powerful innovative approach to synthesizing human interest and species needs, with the ultimate, enticing possibility of bringing them into better alignment.

REFERENCES

1. P. Brakes, S. R. X. Dall, L. M. Aplin, S. Bearhop, E. L. Carroll, P. Ciucci, V. Fishlock, J. K. B. Ford, E. C. Garland, S. A. Keith, P. K. McGregor, S. L. Mesnick, M. J. Noad, G. N. Di Sciara, M. M. Robbins, M. P. Simmonds, F. Spina, A. Thornton, P. R. Wade, M. J. Whiting, J. Williams, L. Rendell, H. Whitehead, A. Whiten, C. Rutz, Animal cultures matter for conservation. *Science* **363**, 1032–1034 (2019).
2. K. M. Ferraro, A. L. Ferraro, A. Z. A. Arietta, N. R. Sommer, Revisiting two dogmas of conservation science. *Conserv. Biol.* **37**,e14101 (2023).
3. C. M. Duarte, L. Chapuis, S. P. Collin, D. P. Costa, R. P. Devassy, V. M. Eguiluz, C. Erbe, T. A. C. Gordon, B. S. Halpern, H. R. Harding, M. N. Havlik, M. Meekan, N. D. Merchant, J. L. Miksis-Olds, M. Parsons, M. Predragovic, A. N. Radford, C. A. Radford, S. D. Simpson, H. Slabbekoorn, E. Staaterman, I. C. van Opzeeland, J. Winderen, X. Zhang, F. Juanes, The soundscape of the anthropocene ocean. *Science* **371**,eaba4658 (2021).
4. D. J. McCauley, M. L. Pinsky, S. R. Palumbi, J. A. Estes, F. H. Joyce, R. R. Warner, Marine defaunation: Animal loss in the global ocean. *Science* **347**, 1255641 (2015).
5. N. Mouquet, J. Langlois, N. Casajus, A. Auber, U. Flandrin, F. Guilhaumon, N. Loiseau, M. McLean, A. Receveur, R. D. Stuart Smith, D. Mouillot, Low human interest for the most at-risk reef fishes worldwide. *Sci. Adv.* **10**, eadj9510 (2024).
6. R. Froese, D. Pauly, FishBase (2000). www.fishbase.org.
7. B. Thomsen, J. Thomsen, K. Copeland, S. Coose, E. Arnold, H. Bryan, K. Prokop, K. Cullen, C. Vaughn, B. Rodriguez, R. Muha, N. Arnold, H. Winger, G. Chalich, Multispecies livelihoods: A posthumanist approach to wildlife ecotourism that promotes animal ethics. *J. Sustain. Tour.* **31**, 1195–1213 (2023).

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