

Research Provides First Global Analysis of Wild Collection

By: Malcolm Gray Levison

A well-known topic of controversy shared by many reef-keeping hobbyists, environmentalists, and even policy-makers is the sustainability and potential harm caused by the wild collection of aquarium fish, corals, and other invertebrates to supply the MAT (marine aquarium trade). Despite a multitude of studies having previously investigated the practice, more recent research published in December 2023 applied newly developed methods to assess the impact(s), or lack thereof, caused by wild collection on a global scale, offering new and potentially more accurate insight. Following the analysis of data, the many aspects examined were evaluated for the creation of models to predict the future of wild collection as well as aquaculture as an alternative. Due in part to the increased accuracy of figures estimating future growth of the hobby, researchers believe they were able to generate a more comprehensive analysis of both the direct and peripheral effects than those conducted formerly. Not only were prevalent issues identified, but recommendations were offered as solutions. Additionally, comparisons between the aquarium trade and other fisheries were made, exploitation risks were calculated for commonly collected species, and spatial exploitation risks for large marine ecosystems and ecoregions distributed globally were evaluated. Importantly, this resulted in the prediction of two divergent scenarios, believed to foretell future directions of the reef-keeping hobby. The first, termed the “Business as Usual” scenario, assumes that no solutions will be implemented to solve identified problems, with the second, termed the “MAP Positive” scenario, dependent on implementation of potential solutions for concerning issues. This study represents the first global analysis consisting of numbers, diversity, and biomass of organisms commonly traded, with the inclusion of point-of-first-sale and retail sale values.

Literature reviews of certain former studies were decided to be outdated, such as that of Rhyne *et al.* (2012), a determination that may come as a surprise to many considering that the conclusions from many such studies have seemed very well-founded. However, it should be acknowledged that scientific methods continue to be modified as they always have, in pursuit of employing more rigorous assessments and leading to a marked decrease in excessively high variability of data. However, contrary to what might be expected, the unbiased analysis resulted in the conclusion that their recommended actions, including greater governance, can potentially be implemented by the aquarium industry itself as an alternative to governmental intervention. In fact, it was noted that the marine aquarium trade has the potential to become a paradigm of sustainable fishing, setting an example for other fisheries while simultaneously benefitting members of communities reliant on the industry.

Analysis of Collection and the Supply Chain

Including chain of custody losses, it was determined that approximately 55 million marine organisms with a value estimated to be worth \$2.15 billion enter the trade each year, with invertebrates composing a far greater proportion than fish species. Though \$2.15 billion was identified to be the retail value, the value was found to be unevenly distributed, with the collective value appreciating greatly between the point-of-first-sale value and retail sale value. Data also indicated that logistical issues exist in the supply chain which should be addressed. To place the number of harvested organisms into perspective, a comparison to the number of yellowfin tuna harvested for food revealed only a small difference. While this figure includes all species ranging from small invertebrates such as snails to fish and other vertebrates, it can initially be quite concerning considering the fact that the locations of collection are far from evenly distributed, with nations such as the Philippines supplying over 50% of marine fish imported into the United States. Due to this, exploitation of large marine ecosystems and ecoregions was investigated and assigned rankings which placed each into 1 of 5 categories ranging from a very low level of exploitation to very high.

Identification and Prioritization of Collection Hotspots

Despite certain countries or regions serving as the source of over half of wild-collected organisms, records revealed that collection for the marine aquarium hobby encompasses approximately 12% of the ocean's surface. Though areas supporting the greatest biodiversity were identified as having the highest degree of exploitation, as expected, the majority of other regions where tropical reefs are located were also rated as being "highly" exploited. However, it was noted that the majority of fish species collected had wide distribution patterns, limiting greatest concerns to just 6 species due to either a severely restricted distribution range, an uncommonly high level of popularity in the hobby, or both. Large marine ecosystems (termed LMEs in the article) and ecoregions determined to fall within the "very high" exploitation category were prioritized for monitoring, and mitigation was advised to ease strain on these areas. Though this may sound bleak and condemning, it was acknowledged that due to the financial leverage possessed by the aquarium industry as a whole, positive feedback loops may be established through the creation of appropriate management strategies as an alternative solution to legislative actions. Therefore, pessimism is unwarranted, and there is much room for hope if caution is exercised and care taken to avoid future overexploitation.

Present-Day Aquaculture and Its Place in the Future

An analysis of the current status of marine fish aquaculture revealed that 139 species/genera have been successfully cultured. However, aquacultured fish currently represent only a small portion of total fish in the hobby. It is estimated that by the year 2030, the number of hobbyists will grow to 1.7×10^7 and continue to increase, potentially reaching 3.1×10^7 hobbyists by 2050. If the hobby does grow as predicted, the demand for livestock will as well. While aquaculture may appear an optimal solution to meet this demand, researchers recognized that due to the industry's high present-day reliance on coral reefs, a strong and highly valuable

connection has already been forged between the industry and coastal communities reliant on the industry for their livelihoods. If broken by overemphasizing the implementation of ex-situ aquaculture, which excludes these communities, members of these communities as well as reefs may suffer, as individuals may find it necessary to earn an income through alternative activities such as destructive fishing practices. This highlights the importance of maintaining and fostering this connection. With this said, investment in aquaculture **involving** coastal communities was considered and recommended.

Future Trajectories

Because of the interconnectedness of wild collection, the future health status of reefs, and future prosperity of coastal communities, the previously mentioned “Business-as-Usual” scenario and “MAT Positive” scenario were formulated. Shared by both was the recognition that a steady increase in the number of hobbyists and an increase in degradation of coral reefs combined with a move to ex-situ aquaculture excluding coastal communities would ultimately be detrimental. The scenarios differ in that the “Business-as-Usual” scenario assumes no increased governance will be implemented and an RCP (Representative Concentration Pathway) of 6.0, ultimately predicted to lead to long-term degradation of at least 98% of coral reefs. Far more optimistic, the “MAT Positive” scenario predicts recovery of coral reefs and a strengthened connection between the aquarium industry and coastal communities, assuming governance increases at a consistent rate and an RCP of 2.6. However, it’s important to note that due to the modeled scenarios’ use of different RCP values (which correspond with emissions) and the constant increase in governance used for the “MAT Positive” model, altering either variable would subsequently alter the predicted outcomes.

Recommended Actions to Ensure a Positive Future

Following this careful analysis, governance was found to be lacking, but believed to be of great importance for monitoring wild collection. Therefore, in order to ensure sustainability of wild collection, governance that would lead to increased regulation was recommended in order to establish a positive future for the hobby. Evidence showed support for an increase in governance, believed to be achievable through cooperation between stakeholders in the industry, being in the best interest of locals living in coastal communities who have spent many years, some their entire life, collecting marine organisms for their livelihoods. Another critically important step for achievement of the “MAT Positive” scenario is the move towards reaching net zero emissions. Accomplishment of this goal and those such as the involvement of local community members in aquaculture would require full support of companies and other stakeholders in the marine aquarium industry and the support or participation of hobbyists.

The “MAT Positive” scenario is conceivable; however, in order for it to materialize, it must be viewed as a joint effort, requiring investments from companies involved in the industry and the support of hobbyists. These investments could be used for the creation of a unified sustainable certification system, as suggested by Miltz *et al.* (2017), to increase transparency in

the selection of livestock available for purchase. This would enable aquarium hobbyists to have the choice to support sustainable collection practices. Ideally, the establishment of such a system would also lead to an increase in effective governance, consumer education, and management for the collection of species determined to be “at risk”, and later result in the development of additional strategies to prevent potential overexploitation. While it is likely that an effective, well-functioning system such as this can become a reality, the importance of implementing such a system must be realized.

The present study has identified certain issues related to wild collection and provides recommendations which could and should be implemented. In contrast to the commonly held belief that legislation is the sole option for improving governance and ensuring regulation, researchers believed that, if implemented correctly, the recommended actions can be achieved by the aquarium industry itself. The potential of the industry as a whole to drive change and expedite progress for the attainment of the “MAT Positive” scenario should not be underestimated. If the highlighted recommendations are taken, the marine aquarium industry can, in fact, play an integral role in protecting the livelihoods of many members of coastal communities while simultaneously contributing to reef conservation in significant ways while still allowing hobbyists to grow in number and experience the delight felt by those who take part in the extraordinary hobby of reef-keeping.

Research Study Reviewed:

“Can the global marine aquarium trade (MAT) be a model for Sustainable Coral Reef Fisheries?” (Watson et al., 2023)

<https://pmc.ncbi.nlm.nih.gov/articles/PMC10699785/>

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