

Brief Report

Standing Out in a Big Crowd: High Cultural and Economic Value of *Naso unicornis* in the Insular Pacific

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Abstract: Hundreds of fish species are harvested in coral-reef fisheries in the Indo-Pacific region using a variety of fishing gears. This diversity makes the economics, ecology, and management of reef-associated fisheries inherently complex. However, across insular fisheries spanning the tropical Pacific, one species consistently dominates contemporary fisheries catch: the bluespine unicornfish (*Naso unicornis*, Acanthuridae). I evaluated the relative contribution of *N. unicornis* to commercial fisheries in the insular Pacific region from long-term (>1 year) fishery surveys across various jurisdictions and provide evidence of the contemporary cultural value of this species. Overall, evidence suggests that *N. unicornis* is the most commercially-valuable reef-associated fish species across the insular Pacific. This notion, coupled with a diverse representation of *N. unicornis* across Pacific cultures, suggests that the species is presently underappreciated in its role in coastal fisheries across Pacific Island nations.

Keywords: coral-reef fisheries; unicornfish; *Naso unicornis*; commercial value; Pacific Islands

1. Introduction

Coral-reef fisheries are highly diverse and provide protein or income for nearly one billion people worldwide. In the Indo-Pacific region, reef-associated fisheries target as many as 300 + fish species using a wide variety of gears and techniques, which may change seasonally and are often linked to specific gear types. Additionally, reef fishery activities range from recreational, subsistence, artisanal, to commercial, and often the distinction between these intentions is unclear. Harvested species vary in ecological value and function, encompassing most trophic levels represented on a coral reef. Selection preference for species is largely a function of socio-economic and biological forces, such as demand and marketability, availability, ease of capture, and fish body size [1,2]. For these reasons, fisheries on coral reefs are considered challenging to characterize, study, and manage. However, despite the diversity that characterizes reef fishery harvests, most coral reef-associated fisheries are generally dominated in mass by a small minority of species [3,4].

I highlight one species in particular that emerges as paramount throughout its geographic range, especially in the insular Pacific region: the bluespine unicornfish *Naso unicornis*. The bluespine unicornfish ranges across the Indo-Pacific from the Red Sea and East Africa to the Hawaiian Islands and French Polynesia. It is a common and desired food fish targeted by net, hook-and-line, and most commonly nighttime spearfishing. It is also widely considered to be of great ecological importance in coral-reef environments [5–7], as it is one of a limited number of browsing herbivores that consume fleshy macroalgae (predominantly *Turbinaria*, *Dictyota*, and *Sargassum* spp.) [5,8]—freestanding autotrophs that compete with and hinder growth of reef-building corals [9,10]. This study summarizes high-resolution

commercial fishery surveys to determine the relative contribution of *N. unicornis* to the economics of insular coastal fisheries of the Pacific Ocean. It further summarizes evidence of the species' contemporary cultural value.

2. Results

Across the Pacific, the likeness of *N. unicornis* is frequently used in national postage stamps, company and event logos, indigenous artwork, and even as school mascots (examples in Figure 1). Such contemporary uses highlight its iconic status throughout the Pacific Islands, likely owing to its value as a food fish, its relatively large size (>60 cm maximum length), and its unique appearance punctuated by a prominent cephalic horn. A summary of nine long-term and high-resolution fishery market surveys from four very distinct Pacific Island regions (Hawaiian Islands, Mariana Islands, Caroline Islands, Samoan Archipelago) revealed that *N. unicornis* was the top ranked species by harvested biomass at five islands, was ranked second and third at two other islands, and only went as low as seventh place at the lowest ranking region (Hawaiian Islands, Table 1). Numerically (as in the total number of individual specimens harvested), the species consistently ranked in the top ten at all locations except in the Hawaiian Islands. The discrepancy in biomass rank versus numerical harvest rank reflects the relatively large body size of *N. unicornis* compared with other harvested coral reef fishes. In fact, *N. unicornis* was frequently the most numerically abundant species harvested among species with an asymptotic fork length exceeding 40 cm. The only other large-bodied species (by this criteria) that compared was the parrotfish *Hippocampus longiceps*, which in some cases was more abundant in commercial harvests, but was often harvested at smaller mean body sizes. Bluespine unicornfish often comprised greater than 10% of the total harvested biomass in reef-associated fisheries, with the highest proportion observed on Guam reaching just under 30% of the total commercial biomass.

Table 1. Summary of rankings for *Naso unicornis* (by harvested mass and number of harvested individuals) in reef-associated commercial and artisanal fisheries of United States-affiliated Pacific Islands and Micronesian islands for which long-term (generally > 1 year) and high-frequency data were available.

Island/Fishery	Biomass Rank	Numerical Rank	Reference
Guam	1st	2nd	CFBP ¹
Saipan ²	1st	5th	[11]
Hawaii	7th	13th	HDAR ³
Tutuila ⁴	3rd	7th	CFBP ¹
Pohnpei ⁵	1st	4th	[4,12]
Yap ⁵	1st	5th	[13]
Palau	1st	4th	Houk & Cueto-Bueno, unpub data
Chuuk ⁵	6th	10th	[14]
Kosrae ⁵	2nd	8th	[15]

¹ NOAA Commercial Fisheries Biosampling Program; ² Commonwealth of the Northern Mariana Islands; ³ Hawai'i Division of Aquatic Resources; ⁴ American Samoa; ⁵ Federated States of Micronesia.



Figure 1. The likeness of the bluespine unicornfish *Naso unicornis* is common across the insular Pacific region, demonstrating its ubiquitous importance to Pacific cultures. Examples include: (a) postage stamps (examples from New Caledonia [Left and Center] and Tokelau, territory of New Zealand [Right]); (b) company and event logos (Left: event t-shirt from 2017 Inter-Pacific Spearfishing Championships; Center: hanging sign for restaurant in Palau, reproduced with permission from George Roff; Right: company logo for non-profit organization from Micronesia, reproduced with permission from Peter Houk); (c) mascots (Left: school mascot for Tanapag Middle School, Saipan, Commonwealth of the Northern Mariana Islands; Center: logo for marine sanctuary in Saipan; Right: mascot in Saipan parade, reproduced with permission from Jihan Younis); and commonly seen in (d) regional artwork (Left: storyboard carving in Palau, reproduced with permission from Javier Cuertos-Bueno; Center: street graffiti in Saipan, reproduced with permission from Javier Cuertos-Bueno; Right: original gyotaku artwork for sale in Oahu, Hawaii, reproduced with permission from Naoki Hayashi).

3. Discussion

The general importance of *N. unicornis* to commercial fisheries in the Pacific Islands has been highlighted previously, reviewed in Table S1 of [5] and Table 1 of [6]. However, by examining long-term and high-resolution surveys of fishery landings across nine distinct regions, this study firmly places *N. unicornis* into context as one of, if not the most economically important species in coral-reef associated fisheries across the insular Pacific. The total commercial dollar value of the species in the United States-affiliated Pacific certainly exceeds that of all other reef-associated species, and this economic disparity likely extends across the insular Pacific region given its widespread distribution, and is a valuable food fish across its entire range (reviewed in [5]). The inherent diversity of coral reef fisheries means many species are targeted representing a wide variety of life-history characteristics.

Large-bodied species are certainly preferred given the higher monetary value of a single individual, but the typical numerical dominance of small-bodied species generally reflects the ease of capture of many abundant species. Many socio-economic, cultural, geomorphological, and biogeographic factors combine to facilitate unique species' contributions in regional coral-reef fisheries. For instance, in the Mariana Islands and elsewhere, it is often the case that smaller 'plate-sized' fish of a coral reef species are preferred by the consumer, which to some extent plays into the general size of fishes available in markets. However, across islands in the Pacific Ocean, *Naso unicornis* was the only large-bodied species to consistently remain within the top species harvested across geographically disparate regions.

The bluespine unicornfish is highlighted in diverse ways in Pacific communities (Figure 1), a testament to its high contemporary cultural value. In the scientific literature, the species has received considerable attention for its functional role as a browser of macroalgae within coral reef ecosystems [5,7]. Based on the evidence presented here, I posit that the species is presently underappreciated in the scientific literature regarding its cumulative value to commercial and artisanal coral reef fisheries. The species is noted to have a peculiar life history compared with many harvested tropical fishes [16–18], and regional declarations of overexploitation [19,20] are perplexingly not met with temporal declines in the fishery [6,21]. Clearly, the nexus between ecological and commercial value warrants enhanced research on the sustainable harvest of this species.

4. Materials and Methods

I assessed the relative contribution of *Naso unicornis* to the commercial fisheries in the tropical Pacific by summarizing species ranks in fishery datasets. Detailed surveys of commercial fisheries are rare across the insular Pacific, and many do not span long temporal periods. I used the criteria of high-frequency (at least weekly) surveys spanning a minimum of one year to select data sets for summarization. Each survey also measured body length or weight of fish specimens (or a subset of specimens) encountered. These criteria yielded seven data sets that have been summarized in the peer-reviewed or grey literature, mostly stemming from the Micronesian region and within the United States-affiliated islands and the Federated States of Micronesia (FSM). These included long-term (>1 year) commercial fishery surveys from Guam (methods provided in [22]), Saipan (Commonwealth of the Mariana Islands) [11], Tutuila (American Samoa; methods provided in [22]), Pohnpei (FSM) [4,12], Chuuk (FSM) [14], and Kosrae (FSM) [15]. I accessed State of Hawaii fishery market surveys (which summarize commercial landings in the Main Hawaiian Islands) from the Hawaii Division of Aquatic Resources Commercial Marine Landings for the period 2010 to 2015. An unpublished data set from Palau (Houk and Cuetos-Bueno, unpublished data; collected over a one-year period spanning 2017) followed protocols from Cuetos-Bueno et al. [14] and Houk et al. [15]. Finally, I included a fishery market survey from Yap [13] that spanned only six months but had a high-frequency of sampling (nearly 75% of days surveyed). For each region, I summarized species rank by harvest proportion (relative contribution to total harvest biomass and total number of individuals caught) to determine the relative importance of *N. unicornis* to regional reef-associated commercial fisheries.

Additionally, I reached out to regional stakeholders requesting examples of the cultural value of *N. unicornis* within Pacific Island communities. Specifically, I requested examples of contemporary uses of the species' likeness observed on an ordinary daily basis.

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