



## Background Information on Aquarium Collecting of Achilles Tang (*Acanthurus achilles*) in West Hawai'i



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April 2018

The following Table lists the top 5 collected White List species in West Hawai'i, comprising 95.8% of the total catch, and provides population estimates and the percentage of the population taken by aquarium collectors in areas open to collecting. "Catch" is the average aquarium catch over FY 2016 - 2017 and "30'-60' Population" is an estimate of the total numbers of fish (including recently settled Young of the Year - YOY) in open areas of hard bottom reef habitat in 30'- 60' depths. Population estimates are derived from Division of Aquatic (DAR) West Hawai'i Aquarium Project (WHAP) survey densities (2016-2017) and area estimates from NOAA habitat maps. "Catch as % of Population" is the % of the species' population in collected open areas taken annually by aquarium collectors.

Common Name	Scientific Name	Catch	30'-60' Open Area Population	Catch as % of Open Area Population
Yellow Tang	<i>Zebrasoma flavescens</i>	303,119	2,224,149	13.63%
Goldring Surgeonfish (kole)	<i>Ctenochaetus strigosus</i>	35,304	4,662,582	0.76%
Orangespine Unicornfish	<i>Naso lituratus</i>	8,189	205,992	3.98%
<b>Achilles Tang</b>	<b><i>Acanthurus achilles</i></b>	<b>6,540</b>	<b>13,960</b>	<b>46.85%</b>
Chevron Tang	<i>Ctenochaetus hawaiiensis</i>	5,046	105,047	4.80%

Based on the above analysis aquarium collecting is having the largest impact on Achilles Tang (aka Pāku'iku'i) where 46.85% of 30'-60' open area population is collected annually.

Catch as a percentage of the *total* West Hawai'i population of a species in these depths is substantially lower than indicated in the above table since *total* population also includes fishes in protected areas (FRAs and MPAs) as well. Total population and catch % are shown in the following Table and can be compared with the table above. It should further be noted that the % catch does *not* include targeted fishes which occur in waters shallower than 30' or deeper than 60'.

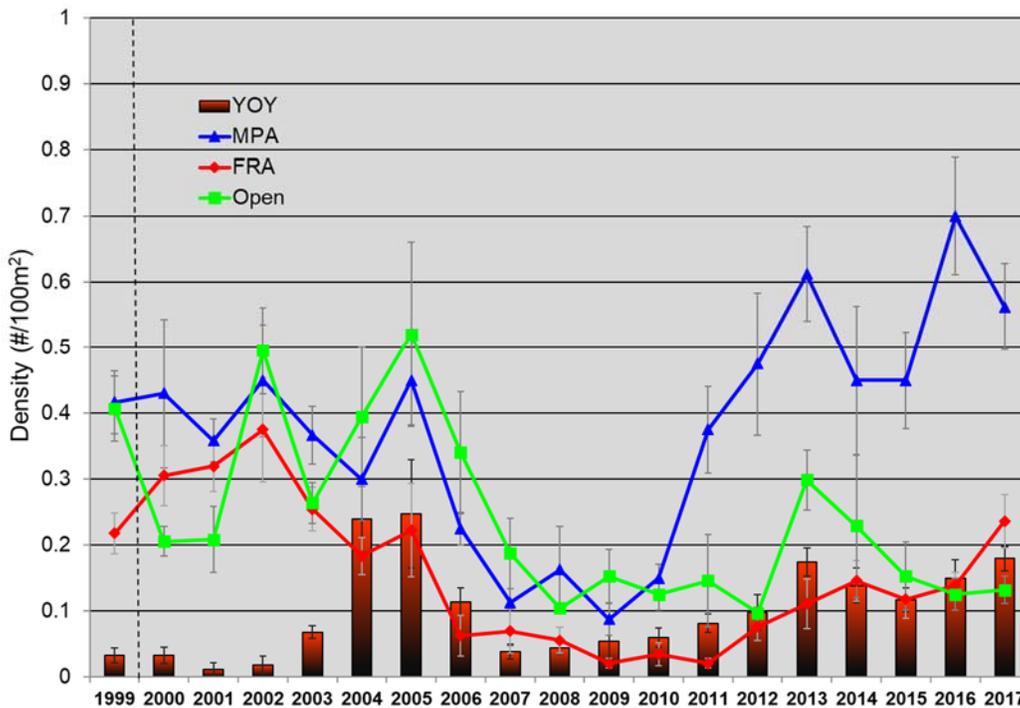
30'-60' hard bottom habitat - WHAP					
	Open Pop	FRA Pop	MPA Pop	Total Pop	Catch as % of <b>Total Pop.</b>
Yellow Tang	2,224,149	2,289,658	487,163	5,000,970	6.06%
Goldring Surgeonfish (kole)	4,662,582	3,024,347	826,841	8,513,771	0.42%
Orangespine Unicornfish	205,992	36,801	38,445	281,238	2.91%
<b>Achilles Tang</b>	<b>13,960</b>	<b>10,817</b>	<b>8,355</b>	<b>33,133</b>	<b>19.74%</b>
Chevron Tang	105,047	67,918	22,430	195,395	2.58%

In 2010-2016, NOAA's Coral Reef Ecosystem Program (CREP) conducted 138 surveys in West Hawai'i waters in depths from 1.6m to 28.1m (5.2' to 92.2'). The following table shows the estimated West Hawai'i populations of the top 5 collected species and catch as % of total population (as above). Note: No Achilles Tang were recorded on surveys deeper than 18m.

<30m hard bottom habitat - CREP		
	Total Population	Catch as % of <b>Total Pop.</b>
Yellow Tang	6,022,548	5.03%
Goldring Surgeonfish (kole)	6,986,664	0.51%
Orangespine Unicornfish	465,745	1.76%
<b>Achilles Tang</b>	<b>49,143</b>	<b>13.3%</b>
Chevron Tang	450,464	1.12%

The catch of Achilles Tang as a % of its West Hawai'i population is considerably higher than the other most heavily collected species. This is especially the case if only the population in collected areas (i.e. Open Areas) is considered. If annual recruitment is low and thus insufficient to replace fish being taken by aquarium collectors, population decline is highly likely. Additionally, Achilles Tang is a popular food fish and larger fish (i.e. 'breeders') are taken for human consumption.

Achilles Tang has had very low levels of recruitment over the past two decades (Figure 1). The mean density of YOY over the past 19 years in the WHAP sites has only been 0.11/100m<sup>2</sup> with similarly low levels (0.10/100m<sup>2</sup>) over the last decade. The WHAP sites are in the depth range most typically occupied by Achilles Tang YOY (and juveniles) and are thus well suited for assessing recruitment strength. CREP surveys found even lower YOY densities - 0.05/100m<sup>2</sup>. This long-term low level of recruitment stands in mark contrast to YOY abundance for the two most heavily collected species. Mean Yellow Tang YOY abundance over the last decade was 64X greater (6.43/100<sup>2</sup>) than Achilles Tang YOY and Kole YOY abundance was 58X greater (5.80/100m<sup>2</sup>).



**Figure 1. Overall changes in Achilles Tang abundance in FRAs, MPAs and Open areas, 1999-2017. Vertical bars indicate mean density (June-Nov) of Achilles Tang Young-of-Year (YOY). YOY are *not* included in trend line data**

Decline of Achilles Tang populations in West Hawai'i is evident from several data sources. As can be seen in Figure 1, Achilles Tang have declined in FRA and Open areas over the last two decades. A similar trend was

apparent within MPAs until 2010 when numbers began increasing somewhat, albeit overall densities remain low. Some of the MPAs have regulations which limit/restrict the take of Achilles Tang by non-aquarium fishers.

Data from 3 long-term studies in South Kona and South Kohala show a similar pattern of decline over the past decades (Figs. 2, 3 & 4).

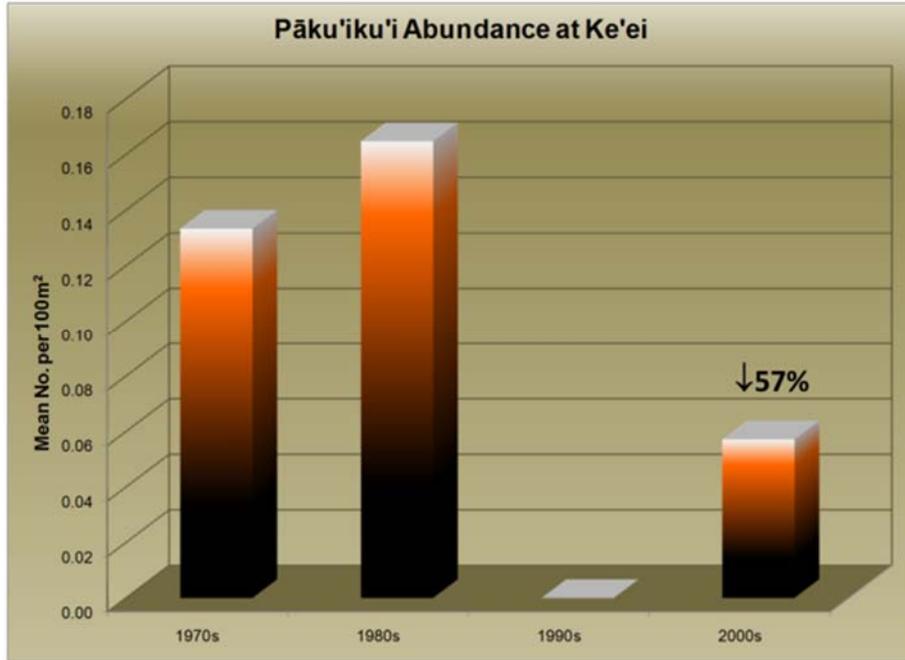


Figure 2. Long term changes in Achilles Tang populations at Ke'ei, South Kona.

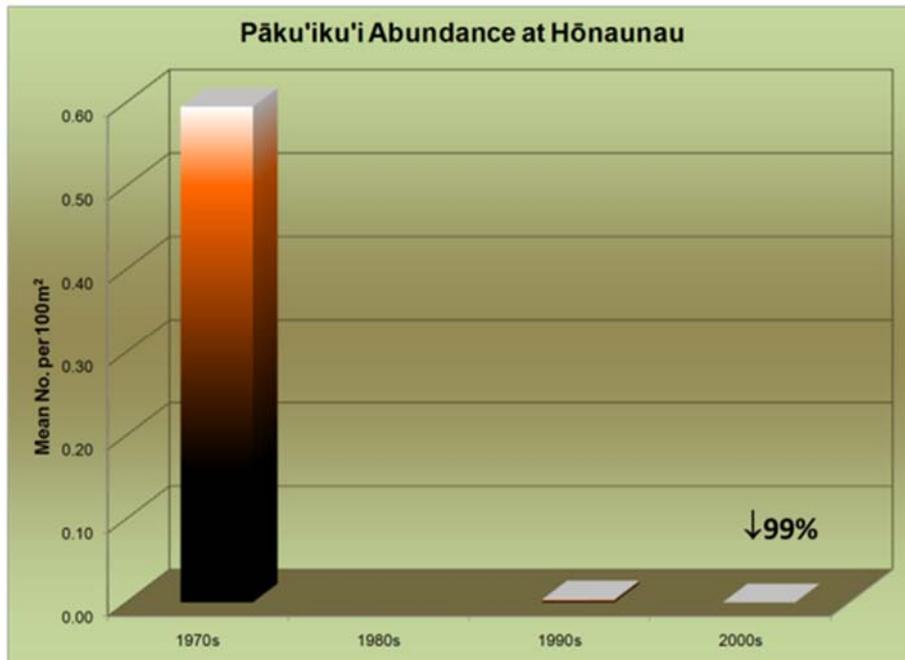
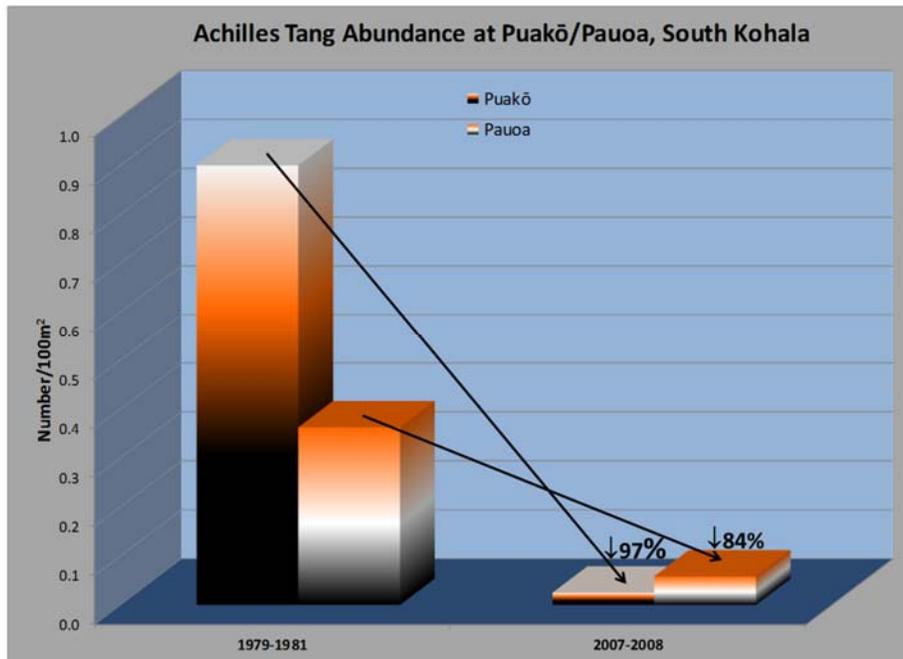


Figure 3. Long term changes in Achilles Tang populations at Hōnaunau, South Kona.



**Figure 4. Long term changes in Achilles Tang populations at Puakō/Pauoa, South Kohala.**

While not overly abundant even decades ago at these sites, it's clear that populations of Achilles Tang have declined in West Hawai'i over the past several decades. As noted, recent surveys also indicate a continuing decline in all management areas excepting MPAs where the species is more protected.

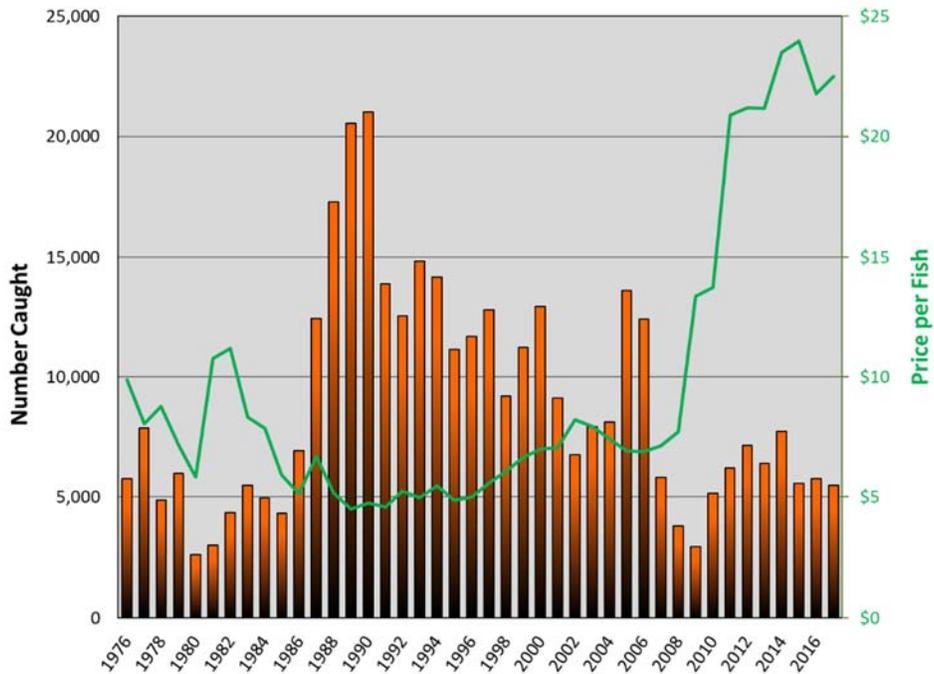
Given the above documented population declines, it is not surprising that commercial aquarium landings of Achilles Tang have also been declining in West Hawai'i over the past two decades (Figure 5). The West Hawai'i Achilles Tang catch peaked in 1990 at 21,023 fish. Catch has steadily declined by almost 74% over the years with a 2017 reported catch of 5,473 fish.

The decrease in catch has occurred in association with a 227.5% increase in the ex-vessel value of the fish (adjusted for inflation) since 2006. The opposing trends in catch and value are strongly indicative of increasing scarcity.

At the end of 2013, a new West Hawai'i Regional Fishery Management Area Rule (HAR § 13-60.4) was signed by Governor Abercrombie. Included in the administrative rule was an Achilles Tang bag limit of 10 fish/person/day which applied *only* to aquarium collectors.

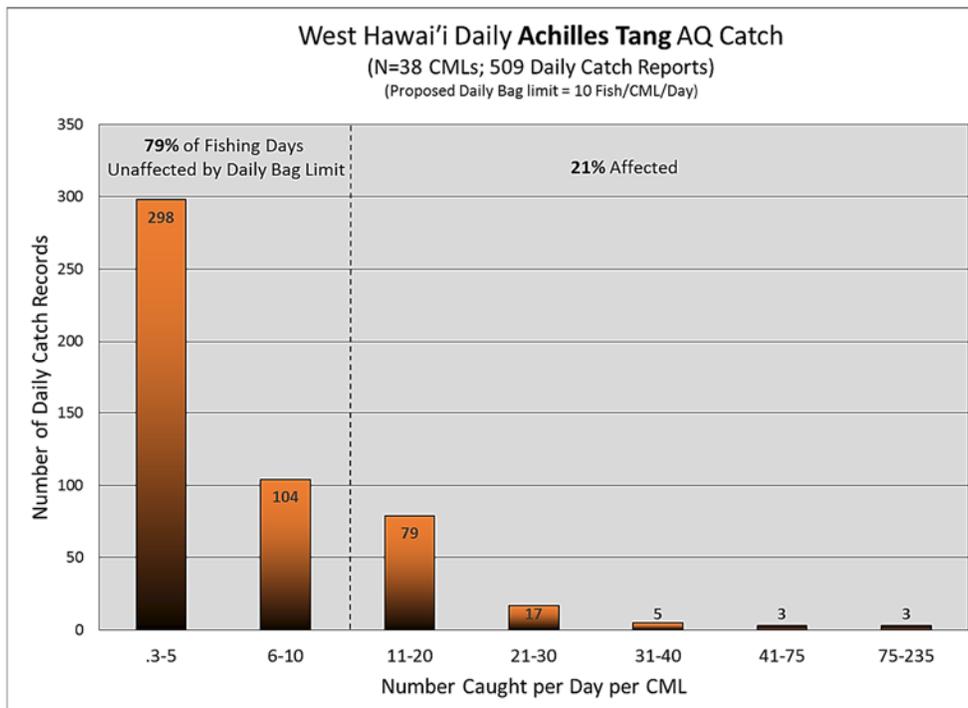
Additionally, beginning in January 2012, DAR's monthly aquarium catch report was converted to a daily aquarium fishing trip report. This daily trip report provided the opportunity to investigate the potential impact of the Achilles Tang daily bag limit.

In West Hawai'i in 2012, 38 aquarium collectors holding Commercial Marine Licenses (CMLs) collectively caught (and reported) 8,111 Achilles Tang over a total of 515 days effort. There were 6 daily reports (representing 102 Achilles Tang – 1.3% of total catch) which were excluded from the analysis due to multiple day's catch being erroneously reported as a single day.



**Figure 5. West Hawai'i commercial Achilles Tang aquarium landings and value**

79% of the daily catch per CML ( $X = 3.4$  fish/day) was less than the proposed bag limit of 10 fish/day (Figure 6). 21% of the daily catch per CML (Mean = 24.5 fish/day – 25 CMLs) exceeded the proposed daily bag limit yet it represented 65.8% of the total catch (5,267 fish). If the Achilles Tang bag limit was in effect in 2012, it might be anticipated that the total catch would have been reduced by 3,227 fish – a 40.3% reduction in catch.



**Figure 6. Number of Achilles Tang caught per day by West Hawai'i aquarium collectors in 2012. The numbers on the bars represents the number of daily catch reports for each category.**

However, over the 4 years since the bag limit was enacted, the mean annual Achilles Tang catch has decreased only 4.2% and catch actually increased the first year (2014) the bag limit was in effect.

At the present time, it is difficult to precisely project the overall impact of the West Hawai'i Achilles Tang bag limit. On the one hand, if there is good compliance with the bag limit and existing conditions regarding collecting, market forces and population abundances remain relatively stable, then a decrease in overall catch would be anticipated, although it may only be a slight. If targeted effort towards this species should increase, even while limited by the bag limit, total catch could increase. Given the clear evidence for a marked decline in the population of Achilles Tang in West Hawai'i, the existing aquarium-only bag limit of 10 fish/day may prove insufficient to stem this decline.