

Performance Report for NOAA Grant: NA04NMF4630344

Final Report

Prepared for NOAA by the Marine Aquarium Council (MAC)

The goal of this project is to promote the management and sustainable use of coral reefs and reef resources on O'ahu. This shared goal was generously supported by NOAA NA04MF463344 grant to the Marine Aquarium Council initiative for work together with the marine ornamental industry in Hawai'i to achieve four major objectives:

- a. Monitoring and assessment of coral reefs or reef resources
- b. Social-economic and resource evaluation
- c. Coral reef fisheries management
- d. Public education and outreach

1. Narrative Report: Summary of Results

The work undertaken on all of the objectives of the project is summarized here. The focus of the last period of the project was on further work in the first 2 components of the project, which are reported in this report in more detail in section 2 and the annexes.

a. Monitoring and assessment of coral reefs or reef resources

- Existing scientific information was located, reviewed and analyzed to determine the information and data for broadly defined collection areas.
- Significant efforts were undertaken, with limited success, to obtain information from aquarium collectors on specific collection site locations and harvest composition and levels.
- An analysis of gaps (Annex 1) was conducted to establish the monitoring provisions needed for the marine aquarium fisheries of O'ahu to seek MAC Certification for under the Ecosystem and Fishery Management (EFM) Standard.
- An appropriate framework for collection area management plans on O'ahu and in Hawaii were explored during the project.
- The monitoring and assessment methods (MAQTRAC) were revised during the project based on the experience in the Philippines, Indonesia and the Pacific and a manual developed to support the use of the methods.

b. Social-economic and resource evaluation

- Stakeholders were identified and characterized and leverage points and incentives for industry members and stakeholders identified.
- The O'ahu marine aquarium industry was researched and the information compiled and documented in a "profile" of the O'ahu industry and fishery (Annex 1).
- Stakeholders in the Hawai'ian marine aquarium industry were identified and their issues and concerns were compiled as best possible.
- Early in the project the socio-economic survey methods and approach used by MAC and its partners in West Hawaii were reviewed and determined to be less useful for O'ahu due to the intensive nature of the methods and the disperse nature of the aquarium industry, e.g. there is no collective process that brings together the marine aquarium industry operators on O'ahu.

c. Coral reef fisheries management

- Throughout the project, information and opinions about managing the marine aquarium fishery on O'ahu were periodically exchanged with some industry operators, especially wholesalers.
- Three potential "early adopter" companies were identified.
- MAC worked with the State of Hawaii DAR, the industry and other stakeholders to consolidate the State and federal regulations into documentation that will fulfill the management requirements for MAC Certification under the Ecosystem and Fishery Management (EFM) Standard.
- Collection, husbandry and transport management practices for the marine ornamentals were studied and interaction with the state government agencies was undertaken to promote improvements to management.
- An analysis of the gaps in management was completed to identify practices needed for O'ahu fisheries to become MAC Certified.

d. Public education and outreach

- Further meetings with key stakeholders were conducted to raise awareness of management alternatives for a sustainable marine aquarium trade in Hawaii and informational materials were disseminated.
- Marine aquarium fish collectors, buyers and exporters were provided with outreach and knowledge support to facilitate MAC Certification in the industry in Hawaii.
- Throughout the project MAC made phone and email contact with industry operators about becoming MAC Certified and information about MAC Certification provided.
- Implementation manuals and other outreach materials to provide concrete guidance to achieving MAC Certification were developed and provided to industry members.

- Information about MAC Certification was provided to Waikiki Aquarium in O’ahu and used in public outreach.
- Key outreach opportunities were created by MAC participation in the National Marine Educators Association (NMEA) conference held on Mau, and associated education events in Hawai’i, during the project.

MAC has fulfilled these objectives as best possible to date with the following achievements, although there have been considerable delays and constraints in implementing this project, due to a variety of unforeseen external and internal factors and staff turnover.

2. Final outputs

2.1 Gap Analysis

In the last phases of NOAA grant NA04MF463344, MAC finalized a gap analysis of monitoring programs relative to marine ornamentals collection on O’ahu’s coral reefs and for the coral reef species targeted by the local aquarium industry. Additionally MAC analyzed the gap between the MAC Standard for Ecosystem and Fishery Management (EFM) and the current management practices for marine aquarium organism collection areas around O’ahu.

This report (Annex 1) provides results of the gap analysis and baseline investigation into the state of health of O’ahu coral reef ecosystems as a part of determining if and how the marine aquarium fishery and trade can be monitored for Ecosystem and Fishery Management.

2.2 Marine Aquarium Industry: O’ahu Profile

Information on the O’ahu marine aquarium industry was compiled and documented in a “profile” of the O’ahu industry and fishery (Annex 2).

The Marine Aquarium Industry of O'ahu

Gap analysis of:

- coral reef monitoring programs relative to marine ornamentals collection
- management practices for marine aquarium organisms relative to MAC Ecosystem and Fishery Management (EFM) Standard

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In general, Hawai'i's coral reefs are in better condition than many other reefs, although urbanized areas suffer from land-based sources of pollution, over-fishing, recreational overuse, and alien and invasive species. Stressors include climate change and coral bleaching, diseases, tropical storms, coastal development and runoff, coastal pollution, tourism and recreation, fishing, trade in coral and live reef species, ships, boats and groundings, marine debris, invasion of non-endemic species, and security training.

Hawai'i's Coral Reef Assessment and Monitoring Program (CRAMP) was established in 1998 to monitor long-term changes in coral reef benthic communities around the state. Recently the program released a comparative evaluation of coral ecosystem health on the major Hawai'ian islands, as defined by reef fish endemism, total coral biomass, and reef fish coral cover on hardbottom, on the major Hawai'ian islands (see Table 1). Based on this data the health of O'ahu coral reefs appear to be consistent with the health of reefs on the other major Hawai'ian islands, despite sustained harvest of coral reef organisms by the ornamental marine aquarium industry.

The analysis of the marine aquarium organism collection effort on O'ahu is a necessary precursor to understanding how the MAC EFM Standard can be applied to the situation of O'ahu. The O'ahu marine ornamentals fishery is spread around the island's nearshore waters, nearly all of which is accessible to collectors and legally open for collection activities. An estimated 50% of the live catch of organisms destined for aquariums occurs off the leeward west coast in the Waianae area, where water conditions are clear, warm and stable year-round. However, given the small size of the island, collectors are able to target several collection areas in a single day. The result is that the specific areas targeted most frequently by the industry are not known to the State of Hawai'i and are not monitored for impact.

In contrast to the location of marine ornamentals harvesting, nearly all of the coral reef monitoring effort on O'ahu occurs on the windward coast over a 20 mile stretch of coast between Waimanalo and Kaneohe Bay, where weather and water conditions for collecting are unfavorable. The waters of Kaneohe Bay are turbid and recruitment of coral reef organisms is low overall. It is a source area for the targeted catch of invertebrate organisms, a catch that the State of Hawai'i believes to be significant. Nevertheless the monitoring in this area is not comprehensive nor conducted by the State, but by scientists based at the University of Hawaii and Hawaii Pacific University, and does not include any methods for measuring the impact of the catch by the local aquarium trade.

Collectors are required to report their catch according to zones set by the State as shown on a map that accompanies the collectors' catch reports. The zones are contiguous pie shaped wedges around the island. Primary research conducted with O'ahu collectors suggested that they were dissatisfied with the format of the catch reports, which were said to reflect the species typical of the

commercial catch on the Island of Hawai'i and not the O'ahu catch. They complained not only that the report was difficult to complete (collectors had to return to it twice, first to report what species were caught where, and second to report what was sold where), but that under-reporting was widespread because of fears that industry access might be reduced by political actions. This has changed recently however during the latter part of the project period, when the State of Hawai'i announced not only a crackdown on enforcement, by linking inaccurate reporting to license loss, but also started to allow some collectors and dealers to report catch data electronically. Among wholesalers, at least, regulation of the O'ahu industry was perceived to have taken a major step forward.

Although there have been some significant changes during 2005-6, it remains the case that there is no active area-based monitoring of marine aquarium industry effort on O'ahu. Area-based monitoring of industry effort is a fundamental requirement for compliance with the MAC EFM Standard and therefore for MAC Certification. Although the State of Hawai'i requires collectors to submit catch reports that detail the number of each species caught by zone, this data has not been analyzed in over ten years.

The Hawai'i State government, through the Department of Land and Natural Resource's (DLNR) Division of Aquatic Resources (DAR) has developed a comprehensive monitoring program for aquarium collection areas on the Island of Hawai'i. The program involves 23 fixed sites that are surveyed intensively four times a year. Comparison of aquarium industry-targeted fish populations and recruitment dynamics in no-take and open fishing areas is a hallmark of this program. This area-based management system evolved in sync with the needs and concerns of the local community. A similar protocol is not being considered for O'ahu because: (1) it does not appear to the DAR that collection effort is substantial and (2) similar community pressures to limit the ornamental catch are not evident on O'ahu. Increased regulation and monitoring of the impact of the Kona ornamental industry were results of a DAR-led process to mediate between the industry and competing local interests - dive shops and hotel and residential developers - which sustained an attack on the aquarium industry since the 1980s. In contrast to the Island of Hawai'i, on O'ahu there is little organized opposition to the industry on O'ahu and limited concern expressed by stakeholders outside the industry regarding the impacts.

The Marine Aquarium Council gap analysis sought to establish what further management and monitoring provisions are needed for O'ahu collection areas to become not only MAC certifiable according to the EFM Standard but well managed for sustainability. "Managed collection areas" can be defined by the following:

- geographical boundaries
- ownership and political boundaries
- identification of all stakeholders relevant to the collection area

- availability of reliable annual catch data
- description of area's collection and fishing history
- list of organisms significant to the fishery
- process for monitoring the fishery and for catching any evidence of destructive and illegal practices, and
- process for identifying unsuitable species.

An authority must be in place to implement and enforce a collection area management plan, and it must possess mechanisms for monitoring the targeted species populations in the collection area and for communicating with relevant stakeholders. These are basic principles of area-based resource management. Area-based management of O'ahu areas targeted by the marine ornamental industry is a fundamental starting point. Collection effort and monitoring must coincide within a bounded area for impact assessment. This would require that the catch data reported by collectors by zone in a period be tracked and matched to the monitoring results for that zone for the same period.

MAC promotes the use of a baseline monitoring protocol called MAQTRAC. The protocol sets in place the elements of a collection area management plan. The main objectives are to:

1. Determine the status of resources
2. Set total allowable catch
3. Recommend sites for no-take zones

A typical MAQTRAC report describes the size and general description of the collection area, the survey period, survey team, and data collection methods. It presents a table of Total Allowable Catch for targeted species, summarized catch records, a list of the no take areas within the collection area, and a list of species requiring further research and careful monitoring of collection rates. Analysis of the material is presented in the form of recommendations, conclusions and documentation.

The Marine Aquarium Council has promoted the concept of establishing a pilot aquarium collection area on O'ahu by applying a MAQTRAC monitoring protocol at a geographically bounded site. The best site to choose would be a collection zone defined by the State of Hawai'i for which systematic catch data is available. In other words, the ideal pilot area is one of the zones that the State has found to be a major target area for the ornamental industry.

In an attempt to establish baseline assessment for critical collection areas on O'ahu, the Marine Aquarium Council sought to obtain zone-based catch data. It was not yet available from the DAR, due to a labor shortage, however the DAR will endeavor to make it available to MAC and there is willingness to provide the information, once available, in an on-going manner.

A very brief summary is provided below from the results of MAC's investigation into the current state of knowledge of Hawai'i coral reefs.

Table 1

Data Used to Evaluate Hawaii Coral Ecosystem Health and Value

Island	Reef Fish Endemism (% Abundance)	Total Biomass (Tons/hectare)	Reef Fish Coral Cover on Hardbottom (% Live cover)
O'ahu	38 D	0.6 B 0.4 D	11 D 14.4 M
Hawaii	22D	0.6 B 0.4 D	20 D
Maui	33 D	0.8 D 0.9 D	27 D 30.4 M
Molokai	24 D	0.5 B 1.0 D	41 D 8.6 J 44 M
Kauai	35 D	0.4 B 0.6 D	16 D 7.5 M
Lanai	15 D	0.6 D	15 D 34.1 M
Ni'ihau	39 D	0.7 D	4 D 0.3 M
Kaho'olawe	10 D	1.3 B 0.6 D	54 D 32 I

Adapted from Jokiel and Rodgers, 2005 with the following data references:

B Friedlander and DeMartini (2002)

D Rodgers 2005

I Jokiel et al. (1993), 33 sites

J Eric K. Brown (personal communication to Jokiel & Rodgers)

M Jean Kenyon and Greta Aeby (personal communication to Jokiel & Rodgers)

The Marine Aquarium Industry

O'ahu Profile

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The Marine Aquarium Industry: O'ahu Profile

Summary

A vibrant, diversified and productive marine aquarium industry occurs on the Island of O'ahu in Hawai'i. Diverse species of coral reef fishes and invertebrate species are collected from dive spots around the O'ahu coastline (125 and 65 taxa respectively, Walsh 2004; see appendices) by divers who work independently or in groups of 2-5 for a wholesaler. The catch is sold locally or exported directly to the US mainland, Japan or Europe. Shipment is possible to anywhere in the world given Honolulu's global transportation infrastructure.

There are eight major wholesalers and 69 licensed collectors of marine aquarium ornamental organisms on O'ahu. Eighty percent of the organisms they handle are trans-shipped from elsewhere in the Pacific. "We don't catch that much fish on O'ahu, we don't need local fish." asserts Richard Xie of Hawaiian Sealife, one of the largest wholesaler-exporters, who maintains a dedicated team of 4-5 divers year-round¹. O'ahu collectors typically work to an open standing order because wholesalers will purchase any quantity of every species brought in, with very few exceptions according to exporter Jeff Jarvis of Island Marine Exports², who said "We can easily re-sell and export everything we can stock". "I have ten times more demand than I can supply", substantiated Richard Xie of Hawaiian Sealife¹.

A typical daily catch consists of 'diversity' ornamental species, meaning a non-specific mix of reef fish and invertebrates captured opportunistically at the dive site. A typical daily catch earns the diver \$500-3000, from which they may pay a share of boat and transport costs, depending on whether or not they are fishing independently or from a company boat. Collectors may target several collection areas in a single day given the small size of the island. However several sources estimated that approximately 50% of the live catch of organisms destined for aquarium tanks occurs off the leeward west coast in the Waianae area^{3,4,5,6}, where water conditions are clear, warm and stable year-round.

It is not clear whether a majority of collectors target regular favored spots around the island's coastline or shift opportunistically. "Collectors rotate on O'ahu. We have 500-600 spots that we go to, using GPS", stated Randy Fernly of Coral Fish Hawaii, another major O'ahu exporter⁴. Alton Miyasaka, manager of the O'ahu aquarium fishery for the Hawai'i Division of Aquatic Resources, believes most collectors target favorite spots repeatedly⁵: "Most collectors are old-timers, they are specialists who know their areas and won't over-collect".

As for monitoring of the industry's impact on O'ahu's coral reef ecosystems and economy, monthly catch data is collected from licensed collectors and wholesalers by the State of Hawai'i but the data has not been analyzed in ten

years. “No-one is looking at the data – it’s there but there is no analysis. We don’t do annual reporting, we should but we don’t.”⁵ There are no plans for new State legislation to increase regulation of the industry of O’ahu, notes Mr. Miyasaka, nor are there any suspicions of concern: “I haven’t heard of any particular species that were once abundant that are now not abundant”⁵.

In January 2007 Mr. Miyasaka offered to prepare an updated summary of catch volumes and values for this report. The results, received February 28, 2007, are presented in Table 1 and explained this way by Mr. Miyasaka: “This is unpublished data. The number of permits represents the number of persons reporting a catch, not the total number of permits issued. For 2006 the total number of permits was 300, with 177 commercial and 130 recreational. I did not break down the number by island but it looks like roughly half between O’ahu and Big Island with slightly more commercial than recreational on O’ahu. The number caught is not the number sold, and only the number collected is reported here.”

Table 1: Catch Volumes and Values for the Island of O’ahu relative to the Island of Hawai’i

Island	Permits	Catch Volume	Catch Value
2002			
Island of Hawai’i	23	216,000	624,000
O’ahu	31	332,000	223,000
Others	12	45,000	120,000
2003			
Island of Hawai’i	26	296,000	808,000
O’ahu	30	475,000	361,000
Others	9	51,000	121,000
2004			
Island of Hawai’i	31	462,000	1,156,000
O’ahu	38	382,000	366,000
Others	7	9000	19,000
2005			
Island of Hawai’i	37	488,000	1,324,000
O’ahu	42	374,000	401,000
Others	4	10,000	29,000

Catch Reporting and Management of the O'ahu Marine Ornamentals Fishery

The specific catch areas targeted most frequently around O'ahu by the marine aquarium ornamentals industry are not known to the State of Hawai'i and are not monitored for impact.

Nearly all of the scientific coral reef monitoring effort on O'ahu occurs on the windward coast over a 20 mile stretch of coast between Waimanalo and Kaneohe Bay. These areas have much of the islands reefs, but also have weather and water conditions unfavorable for collecting. The waters of Kaneohe Bay are turbid and recruitment of coral reef organisms is low overall. It is a source area for the catch of invertebrate organisms, such as the "feather duster worm" or *Sabellastarte sanctijosephi*, that the State of Hawai'i believes to be significant.^{5,6} Monitoring in the area is not comprehensive and is not conducted by the State of Hawai'i but by scientists based at the University of Hawaii and Hawaii Pacific University who are watching more generally for changes in coral reef health and productivity. Current monitoring efforts on O'ahu do not include any measurement of the impact of catch effort by the local aquarium ornamentals industry in any location.

This situation is offset by a new effort launched in 2006 by the State of Hawai'i Division of Aquatic Resources (DAR) to enforce accurate catch reporting by collectors and wholesalers¹. The DAR on O'ahu announced in Spring 2006 that inaccurate reporting would lead to loss of license. Collectors are required as a condition of holding a commercial catch license to report their monthly catch, and to do so by zone according to the map that accompanies State-issued catch report forms (provided in Figure 1). The zones are contiguous pie shaped wedges around the island set to mark natural bays from point to point of land, but the boundaries are arbitrary with respect to the industry's harvest, competing ocean uses or community concerns⁵. An increase in the perception of credibility in catch reporting has occurred within the industry over the past year and is attributed to the new provisions for enforcement announced by DAR¹. This was assisted by DAR provisions that allowed some wholesalers and collectors to submit their catch data online in digital format. According to exporter Richard Xie of Hawaiian Sealife the new digital format has made reporting and error-correcting considerably easier¹. Allowing collectors to report online is DAR's response to their complaints about the difficulty of completing them as required. Collectors were dissatisfied with the species list on the report, which they felt represented the Big Island catch more closely than the O'ahu catch, and with the time it took to manually fill out the numbers for each species both caught and sold per zone³. Amongst wholesalers at least, State management of the O'ahu industry is perceived to have taken a giant leap forward over the past year¹.

Nevertheless, there is still no active area-based monitoring of industry's impact on O'ahu's coral reef fishery resources and the reef ecosystem.

Magnitude and dimensions of the O’ahu marine aquarium industry

Most of the local Hawai’i catch of marine ornamental organisms occurs off the Kona coast of the Big Island of Hawai’i, whereas most of the exporting activity occurs on O’ahu. Even Kona fish are trans-shipped through Honolulu to take advantage of its global shipping network, through which millions of Pacific organisms flow every year.

In 2006 the State of Hawai’i issued 188 commercial permits for collecting marine aquarium organisms with 69 in O’ahu and 80 on the Big Island of Hawai’i. O’ahu’s proportion of the State catch has shrunk since the mid-1990s as measured by the number of commercially-licensed collectors, dropping from 60% in 1994 to 35% in 2006⁸. The size of the O’ahu catch relative to the Big Island catch is similarly smaller, with over 400,000 animals collected from Kona alone in 2006 compared to the stable O’ahu catch of approximately 120,000 organisms^{5,6}. A major decline occurred in the O’ahu collection industry in the 1990s following Hurricane Iniki and its severe damage to Waianae coral reefs in 1992, which are only recently showing signs of recovery^{5,6}.

Historically O’ahu had been the center of the industry and its annual catches accounted for between 64% (1976) and 84% (1981) of the fish catch. The current O’ahu catch accounts for only 12% of the volume of the annual total catch in the State of Hawai’i⁹. According to State of Hawai’i statistics the value of the O’ahu aquarium fish catch declined 76% from 1997 to 2003, adjusted for inflation. The marine ornamental catch on the Island of Hawai’i increased by 282% in the same period⁹.

State monitoring of O’ahu’s coral reefs is conducted with underwater surveys but only in O’ahu’s managed areas (Table 2) where aquarium collecting is not permitted⁵.

Table 2: Managed and Monitored Marine Areas on O’ahu

Managed Areas:	Monitored	Aquarium Fishing Status:
Waikiki	Yes	No-take in odd-#d years
Pupukea	Yes	No-take
Waianae small boat harbor	Yes	No-take
Ala Wai canal	Yes	No-take
Kapiolani Boulevard canal	Yes	No-take
Hanauma Bay	Yes	No-take
Haleiwa harbor	Yes	No-take

Source: Miyasaka, personal communication, 2006

O’ahu collectors target all species of value. They typically collect a mix of the top 5-10 species often mixed with a large catch invertebrates. The content and value

of an O'ahu collector's catch vary significantly from the catch of a collector based on the Big Island of Hawai'i, which is dominated by a single species, the yellow tang (*Zebrasoma flavescens*). Big Island collectors bring in a catch composed of as much as 90% yellow tangs.^{2,5,6} By contrast, the O'ahu catch is dominated by invertebrates according to Hawai'i State statistics (Table 3), although this is disputed by collectors³. New statistics are needed to confirm the predominance of invertebrates in the O'ahu catch. According to the DAR's Alton Miyasaka: "On O'ahu there is still a higher percentage of invertebrates caught than on Kona, but it is possible that a shift in catch composition has occurred since DAR last analyzed the data"⁵.

Table 3: Top Ornamental Species Collected on O'ahu relative to State totals

Species:	Number Sold:	Dollar Value (\$):
Feather duster	12,553	12961
Potter's angel	7061	21592
Green shrimp	5100	4963
Hermit crab	4877	4968
Lemon butterflyfish	4761	4898
<i>O'ahu totals</i>	<i>34352</i>	<i>49382</i>
Yellow Tang	176,598	229,457
Kole	15,188	14467
Achilles Tang	11072	35657
Clown Tang	6788	19959
Long nose butterflyfish	4553	8882
Hawai'i totals	214,199	308,422

Source: Miyasaka, 1997

The total number of commercial licenses on O'ahu appears to have stabilized in recent years, but there are indications that the scope of industry's activities has widened. Not only does trans-shipping now dominate the industry but there is growth in the number of 'collector-exporters' who not only catch but also hold, handle, transport and market fish and invertebrates independently to predominantly US mainland buyers. The local industry that relied on the O'ahu catch was largely lost to hurricane damage a decade ago but appears to be re-professionalizing. Collectors and exporters interviewed for this report described a local industry that is innovative and enterprising, small-scale and self-limiting, but also under-known and appreciated. Currently 5 of 8 major wholesalers on O'ahu do not publish their company names or telephone numbers and do not have websites. Nor is it clear how many collectors are bolstering their local catch with imported Pacific fish for direct export. These factors make it difficult to develop an accurate picture of the O'ahu marine ornamental industry.

The commercial aquarium fishery in Hawai'i has developed over the last 50 years into one of the state's major inshore fisheries, with annual landings of over

708,000 specimens with a reported value of \$1.06 million⁹.

Awareness of Key Stakeholders of Management Alternatives for a Sustainable Marine Aquarium Trade on O’ahu

The O’ahu marine aquarium industry appears to be stable and growing slowly. Little public or visible concern is evident from competing dive shop, tourism and residential stakeholder interests. This is yet another sharp contrast between the O’ahu and the Island of Hawai’i marine ornamental industries, as intense conflicts have defined the Kona industry since the 1970s.

Nevertheless there is a general perception amongst the public in Hawai’i that the marine ornamentals industry is responsible for damage and decline to coral reef ecosystems. Dr. William Walsh, Director of the Division of Aquatic Resources of the Hawai’i Department of Land and Natural Resources, has said that he wants to establish a mechanism that will create 100% confidence in the catch reporting done by Hawai’i collectors and wholesalers⁶. This would help the State government to generate the catch statistics needed to answer the long debated question about whether or not aquarium collecting is damaging coral reef resources in a significant way. “I’ve seen the decline, it’s obvious”, says Dr. Jack Randall, resident ichthyologist at the Bishop Museum in Honolulu, “but it’s likely more about recruitment dynamics than over-collecting”. According to Dr. Randall the best and most effective management response to perceived decline in coral reef populations is to create fish replenishment or ‘no-take’ areas along the O’ahu coastline. This is the way to generate a sustainable fishery and industry, he asserts, “on the basis that they would most definitely contribute to ecosystem balance and reef organism recruitment success”⁷. An initiative to introduce fish replenishment areas was attempted by the State in the 1980s but failed after meeting significant community opposition. “O’ahu would benefit from fish replenishment areas if they were carefully chosen”, asserts Dr. Randall. “areas should be carefully selected to not inconvenience but accommodate collectors”⁷.

Based on interviews conducted within the O’ahu industry on the topic it is safe to say that currently there is little to no appetite or support for fish replenishment areas. “The State is trying to squash my industry”, replied one of the major wholesalers, Randy Fernley of Coral Fish Hawaii⁴, when asked about the concept of instituting limited no-take areas on O’ahu, “We don’t want any restrictions on the collecting areas.” It is clear that O’ahu wholesalers and collectors do not want “what they have in West Hawai’i, where ‘AQ’ is a scarlet letter. It’s too extreme”⁴. “On O’ahu we have less collectors, more grounds, and no conflict. We have no conflict with the dive shops at all. Collectors are never going to agree to collecting in just one or a few managed areas”⁴.

The predominant attitude of industry participants is to hold back against new regulations. But there are some in the industry who anticipate regulatory restrictions are coming, possibly soon. Collector William Crook, who exports his

catch independently, asserted “Everyone knows the reefs are changing, and feels like a hammer is likely to fall at some point. This has driven many underground, they don’t want to admit to what they see or to report accurately for fear of losing access. It’s a vicious cycle.”³ Mr. Crook, like Dr. Walsh, felt that MAC certification of the highly experienced members of the industry could reward good practices and also effect a gentle shift toward better transparency and sustainability in the Hawai’i industry. “A lot of the guys who operate under the radar now are doing so because they don’t want to contribute to the picture of decline and accelerate the dropping of the hammer”.³

According to Dr. William Walsh of DAR there is currently no conclusive evidence to link a decline in Hawai’i coral reef organisms populations to industry exploitation⁶. At the same time he reports that DAR’s first analysis of empirical monitoring data from the ‘no take’ fish replenishment areas (FRAs) along the Kona coast supports the notion that they are working to bolster reef population recruitment⁶. A strong argument for the implementation of fish replenishment areas is found in research reports prepared on O’ahu reefs by Hawai’i’s marine and coral reef ecosystem experts (Friedlander, 2005; Tissot and Hallacher, 1999). DAR’s early findings on Kona FRAs seem to support the theoretical arguments of O’ahu-based experts in favor of fish replenishment areas^{7,10,11}.

The impact of the O’ahu marine aquarium industry on O’ahu coral reefs and reef populations remains a large open question. Everson and Friedlander state that the nearshore recreational and subsistence catch is likely equal to or greater than the nearshore commercial fisheries catch and poses a serious threat to coral reef ecosystems, as recreational and subsistence fishers take more species using a wider range of fishing gear¹². Friedlander linked suspected decline in reef fish populations to diminishing enforcement¹³, and a decline in the number of enforcement personnel on staff at the Hawaii Division of Conservation and Resources Enforcement, citing the average of only 2.3 citations per officer per year in all fisheries combined, recreational, commercial and freshwater¹³. It is difficult to ascribe over-fishing consequences to one fishing user type over another in the absence of the State’s analysis and release of catch report data.

Conclusion

Whether or not, and to what degree, the collecting of ornamental marine organisms on O'ahu plays a role in coral reef degradation and decline in coral reef fish populations is unknown. The current condition of coral reef ecosystems in the main Hawaiian Islands ranges from fair to excellent, but we also know that the threat to reefs is heightened by continual population growth, overfishing, urbanization, runoff, and by commercial development. According to Friedlander, ocean outfalls, urban growth, and coastal developments (hotels, golf courses, and condominiums) are focal points for potential coral reef degradation¹³.

Studies suggest that Hawaiian marine protected areas can effectively promote recovery of heavily exploited fish stocks in bordering areas. Early indications are that the Fish Replenishment Areas along the Kona coastline of the Island of Hawai'i successfully reduced conflicts between collectors and other resource users, promoted a sustainable fishery, and may even have enhanced aquarium fish populations⁶.

Indications are that the O'ahu marine ornamentals industry, and local O'ahu communities, notably Waianae, are opposed to the introduction of area restrictions to fishing.

Friedlander and other O'ahu-based marine experts have said that research is starting to show how various stressors affect coral reefs. Effective programs for monitoring fishery management, ecosystem health and function are developing¹³. Fishing offers important socio-economic values to island communities that must be measured and included in management provisions for them to work well¹³. Socio-economic values and collecting effort need to be measured much more accurately before the impact of the industry can be understood.

Sources

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4. Randy Fernley, Owner, Coral Fish Hawaii; personal communication, May 2006
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17. Alton Miyasaka, personal communication via electronic mail, 28 February 2007.

Appendices

1. List of Targeted Organisms in the Hawai'i Marine Aquarium Industry

Species	Common Name
Acanthurus Achilles	Achilles Tang
Ctenochaetuys strigosus	Kole
Zebrasoma flavescens	Yellow Tang
Naso lituratus	Clown Tang
Zanclus cornutus	Moorish Idol
Pseudocheilinus octotaenia	Eight Lined Wrasse
Thalassoma duperrey	Saddle Back Wrasse
Coris gaimard	Clown Wrasse
Anampses chrysocephalus	Red Tail Wrasse
Halichoeres ornatissimus	Ornate Wrasse
Dascyllus albisella	Aloiloi
Forcipiger flavissimus	Longnose Butterfly
Chaetodon unimaculatus	One Spot Butterfly
Chaetodon multicinctus	Pebbled Butterfly
Chaetodon miliaris	Lemon Butterfly
Chaetodon kleini	Coral Butterfly
Chaetodon quadrimaculatus	Four Spot Butterfly
Centropyge potteri	Potter's Angel
Canthigaster coronata	Saddle Back Puffer
Canthigaster jactator	White Spotted Puffer
Ostracion meleagris	Spotted Boxfish
Gymnothorax eurostus	Common Eel
ANTENNARIIDAE	ANGLER FISHES
Anthias thompsoni	Fairy Bass
Sabellastarte sanctijosephi	Feather Duster Worm
Hippolysmata acicula	Cleaner Shrimp
Stenopus hispidus	Coral Banded Shrimp
PAGURIDEA	HERMIT CRABS
ECHINOIDEA	SEA URCHINS
ASTEROIDEA	SEA STARS

Note: the Hawai'i State Division of Aquatic Resources does not utilize a list specific to the O'ahu catch which, according to Alton Miyasaka of DAR, differs from the catch on the Island of Hawai'i in terms of being a 'top 20' vs. 'top 8' fishery.

2. Wholesalers operating in the O'ahu Marine Aquarium Industry

Hawaiian Sealife, Owner Richard Xie, contact information unavailable
Island Marine Exports, Owner Jeff Jarvis, 329 1898
Coral Fish Hawaii, Owner Randy Fernly 488 8801
Wayne's Ocean World, Owner Wayne Sugiyama 484 1144
RT Enterprises, Owner and contact information unknown
Pacific Kevko, Owner Unknown, 1.866.228.3474, big@kevco.cc

Also commercially licensed in Hawai'i are the following companies:

Abstract Aquatic, C & S Pets, Fish heads, Hawaii Reef Shack II, Aloha Saltwater Fish, Kona Gold Tropics, Marine Oceania, Modern Pet, Mr. Fish, Pisces Pacifica, Salty Waters, Something Fishy, The Pet Shop.