

## Developing a sustainable marine aquarium trade industry on Kiritimati Island

The marine aquarium industry in Kiritimati Island (also called Christmas Island) began in the late 1970s. Today it is now the biggest income earning activity and source of livelihood for the local people, providing much needed cash to pay for school fees, church contributions, and staple food items such as rice, sugar and flour. The industry is currently valued at a minimum of USD 1.5 million annually.

When it started, there was only one exporter of marine aquarium fish from Kiritimati to Hawaii. The operation was small and used a land-based, closed-system holding facility. The collection and handling of fish was very well controlled and, therefore, fish that were exported were of very high quality. The company quickly established a very good reputation, and specialised in the flame angelfish (*Centropyge loriculus*), which fetched a price of USD 25.00 a piece on average. The flame angel became the signature fish for Kiritimati in the 1980s, known for its striking colours compared with the same species from elsewhere in the Pacific. The demand for the flame angelfish from Kiritimati grew steadily but the company controlled the supply and was, therefore, able to maintain the high price. In addition to the flame angelfish, other rare deepwater fish species were found in Kiritimati, including the declivis butterflyfish (*Chaetodon declivis wilderi*), tinker's butterflyfish (*Chaetodon tinkeri*), griffis angelfish (*Apolemichthys griffis*), hogfish or candycane (trade name) (*Bodianus opercularis*), and longnose black tang (*Zebrasoma rostratum*). These highly sought-after fish boosted their demand from Kiritimati,

and with the very high price they commanded, the marine aquarium fish trade in Kiritimati became a highly successful and profitable industry.

In the 1990s, more local Kiritimati people became interested in the industry and the number of marine aquarium operators increased dramatically from 2 to 10 companies. Several of these new companies had no idea or any experience in the marine aquarium fish industry and thus failed, so that by the early 2000s only 6 companies remained. With the increased number of operators and no controls or regulations, there was strong competition among operators to surpass each other in exporting large quantities of fish. This was the beginning of poor management practices and the decline in the overall quality of marine aquarium fish from Kiritimati. This in turn caused a drop in fish export prices, especially of the flame angelfish, which dropped significantly from USD 25.00 to USD 1.00 a piece. In recent times, the price of the flame angelfish has gone up slightly to USD 5.00 a piece.

In spite of the growth and changes in the industry, there has never been any attempt to manage it. As a result of the unmeasured fishing effort, there has been increasing concerns about the current status of the resource and the sustainability of the industry over the long



Flame angels in a Kiritimati land-based facility (Image: Éric Clua).

term. This and the reputation of poor quality fish coming out from Kiritimati caused the Kiribati Fisheries Department to seek technical assistance and advice from SPC. In response to the request, a two-week mission led by SPC's Senior Fisheries Scientist for the Live Reef Fish Initiative was planned and made to Kiritimati from 20 April to 5 May. The team consisted of six others, including two local fisheries officers from the Kiribati Ministry of Fisheries and Marine Resources Development (MFMRD) headquarters in Tarawa, a hired consultant from the industry, the manager of the Coral Reef Initiatives for the Pacific (CRISP) Programme, and a videographer and sound engineer from the local French Television channel RFO in New Caledonia. The mission was

funded collaboratively by a grant to the Live Reef Fish Initiative from the MacArthur Foundation and CRISP, and received local logistical support from the Kiribati government through MFMRD. The RFO crew came along at their own expense with an interest in making a TV documentary about the marine aquarium trade in Kiritimati, but also with an agreement that the video footage they took would also be used as part of an SPC educational awareness video on the marine aquarium trade in the Pacific. The main aims of the mission were to:

- make the necessary improvements to the general marine aquarium industry practices of Kiritimati, with the hope of improving the quality of fish exports;
- train local Kiribati fisheries staff on using and conducting underwater visual census methods so that they could assess and monitor their marine aquarium trade fish resources;
- conduct a fisheries resource survey to assess the status of the marine aquarium trade fish resources in Kiritimati; and
- investigate and assess the opportunities and the interest in Kiritimati for maricultured commodities for the marine aquarium trade, especially the use of post-larval capture and culture methods.

To achieve these objectives, a three-day training workshop for industry people was conducted on collecting and handling practices, from catching the fish to shipping them overseas. In total, 36 local participants attended the workshop, including divers and fish collectors, fish packers and fish exporters.

Training consisted of both classroom lectures and practical sessions. In order to get a better idea of the problems and the local situation, participants were asked about local industry practices such as the types of gear used, methods of catching fish, how fish are handled and kept, and how the fish are packed for shipping. Samples of good practice collection gear were brought to the workshop and shown to participants. Differences between various locally used gear types were highlighted and their use was demonstrated. During field sessions, it was possible to observe first hand how the fish collectors actually caught fish. Best practice collection methods, including gear, were demonstrated so that the fish collectors could see the difference. Hands-on training and advice was also provided on how to decompress fish properly and on the ocean-based system of storing fish on mooring lines.



Fish are stored offshore in perforated fish buckets hung from mooring lines (Image: Tekinaiti Kaiteie).

Two other topics relating to industry practices that were covered during the training included fish holding facilities for storing fish before export, and fish packing methods. The lecture on holding facilities described the technical side of holding fish, and the



Trainees practiced the proper way of bleeding air (“needling”) from the fish bladder through the side (Image: Éric Clua).

holding systems and design of a small and simple closed system holding facility that would be appropriate for the average-size operation in Kiribati. The practical part of this session included a visit to existing facilities to assess their setup and make recommendations on how they could either be improved or how they should set up a new system if none existed. For the fish packing training, several companies demonstrated their methods of packing fish followed by discussions to highlight areas that need improvement to ensure better survival rates and better quality fish exports.



Being Yeeting, SPC Senior Fisheries Scientist (Live Reef Fisheries), shows some "good practice collection gear" to the workshop participants.

Additional issues covered during the workshop included dive safety (which was becoming a problem) and other potential mariculture opportunities for the marine aquarium trade, especially post-larval capture and culture technology, which

was presented by the CRISP Programme Manager.

The Kiribati Fisheries Department was interested in knowing what accounted for the high number of fish reported to be

"dead on arrival" (DOA). Based on an actual assessment of current practices, the following observations of "bad practices" were noted. Solutions to address these practices are provided in the table below.

**Fish collection**

***Bad practices***

The mesh size of nets was too big so many fish were being gilled.

The material used for the current nets used was too hard.

Fish collectors used very short nets that were 1 m long x 0.5 m high, which meant that the handling of fish was very quick and rough in order to avoid them escaping.

Most collectors did not use a probe but used their hands instead to chase the fish into the net. They therefore tend to move many rocks to get to the fish. For those collectors who used probes, the probes were usually short and made of metal, which tended to break the coral when used to get fish out from among the corals.

A lot of fish collectors were putting too many fish in their fish collection baskets.

Many divers/fish collectors do not have their dive cards, so it was difficult to confirm if they had actually ever received proper dive training.

A number of divers/fish collectors actually admitted that they are diving without proper dive training and certification but were taught by diver friends.

Only a few divers that came out in the field practical sessions had good underwater skills.

***Solutions***

Use smaller mesh size nets of 0.5 in. Samples of smaller mesh size nets were distributed to all operators.

Use 0.18 mm twine for nets and knotless mesh. Samples of this light net were distributed to all operators.

Use 10 m x 2 m nets with rubber bands to pull the net back to make pockets. Use of these nets was demonstrated.

Use long fibreglass probes that are flexible and which allow the collector to herd fish from a fair distance away without scaring the fish. This will also prevent breakage of corals. Using these probes was demonstrated and samples were distributed to some collectors.

Do not overstock fish; 10 fish per fish collection basket is recommended.

A proper dive certification course should be organised to re-certify these divers. A regulation on dive certification as a requirement for fish collectors should be imposed.

A proper dive certification course should be organised to certify these divers.

A dive certification course would improve this.

**Fish decompression method**

**Bad practices**

The current method pokes the fish from the underside next to the anal pore and up to the air bladder.

The needles used are not cleaned after every use.

The handling of fish is generally rough.

**Solutions**

The method of poking the fish from the side was introduced and shown to collectors. Some collectors were able to try the method out.

Remind collectors to wash and flush the needle out with seawater between applying it to different fish.

Change the mentality of collectors to treat fish with respect and as living things.

**Fish transport and storage**

**Bad practices**

All operators use the offshore fish storage system where captured fish are stored in individual cups with holes and are hung in a perforated holding bag hung on mooring lines.

When transferring fish from or into the storage bags on the mooring lines, the lines are brought up to the surface and several storage bags with fish are often left out of the water for up to half an hour.

Handling of fish is also rough at this point with new fish transferred into individual plastic cups that are often thrown several meters from the boat into storage bags.

Many fish are stored on the mooring lines for 2 weeks to 1 month before they are pack and shipped.

During transport, after collection and also while sorting decompressing fish, the fish are kept in large plastic bins on board the boat. This water is not changed often enough to get rid of fouled water and ensure good quality water.

**Solutions**

The design and best practices for this system needs to be looked at to make it efficient. Land-based holding facilities have many more advantages and are therefore recommended.

This handling practices should be incorporated in a best practice guideline for the offshore holding system

Change the mentality of collectors to treat fish with respect and as living things.

The offshore holding system is only good for holding fish for 3–4 days maximum, otherwise fish are starved and could develop diseases.

The importance of frequently changing the water in the bins (i.e. at least every 10–15 minutes) was explained.

**Land-based holding facilities**

**Bad practices**

Only 1 operator has an almost complete land-based holding facility but still lacks some vital equipment such as a protein skimmer and UV light.

All operators have always wanted to build land-based, closed-system holding facilities but lack the technical know-how to set them up.

**Solutions**

The setup of a full complete system with the minimum equipment required was described. The function of each vital piece of equipment was explained.

Each operator's facility was looked at and a design of a possible setup for their holding facility with a list of equipment they will need to acquire was provided.

**Fish packing**

**Bad practices**

General method of packing and packing materials is standard.

The general handling of fish is rough in order to save on time,

Efficiency of packing team performance and effective use of packing space needs improving.

Air stones for aeration are sometimes excessively used.

Sometimes packing water is collected from the lagoon rather than from the ocean. Lagoon water is not very clean.

**Solutions**

This was good.

Change the mentality of packers to treat fish with respect and as living things.

A design of a packing table and the organisation of different workers for the various packing stages were presented.

Packers were cautioned on the possibility of injury to fish eyes, which can result from excessive air bubbles.

All companies were asked to always get packing water from the ocean and not from the lagoon.

Training in underwater visual census (UVC) for assessing marine aquarium fish resources in Kiritimati was provided to four local fisheries officers. The UVC method developed by SPC's Reef Fisheries Observatory was used. Once they gained confidence in using this method (i.e. able to recognise and identify common important marine aquarium fish species and estimating their size to within a 10% error margin), the trained fisheries officers were allowed to assist in conducting a proper resource survey of marine

aquarium trade fish resources of Kiritimati.

The survey was conducted in the second week of the mission, and 24 survey stations were selected with 6 stations each on the different sides of the island (i.e. north, south, east and west). Data are being entered and processed by one of the trained fisheries officers under a three-week attachment training at SPC headquarters in June. A survey report and management plan for the marine aquarium trade in Kiritimati

are expected to be one of the results of this attachment.

A follow-up mission will be organised towards the end of the year to look at the potential of PCC and for further refining industry practices and the management plan if required.

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### The "dollar-fish" island

The mission implemented in April 2010 in Kiritimati was the opportunity for a French TV team to join the SPC team. Several hours of footage were taken on the mission itself but also about the island, its people and the local way of life. A 26-minute documentary is in preparation, entitled "The dollar-fish island", to be displayed on French TV channel RFO later this year. This movie will be translated into English by SPC and dispatched throughout the Pacific. The main theme of the movie will be the dependence of Kiritimati Island on its fish resources, both pelagic (tuna), and coastal (marine aquarium industry). The focus will be on the flame angelfish, due to its enormous potential in Kiritimati and because of the ongoing ecological and financial wastage due to the local industry's lack of organisation. The footage will also be used for an SPC technical movie that depicts how capture and handling techniques can be improved in the Pacific aquarium trade.



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