INTERVIEW

BIOTA founder Tom Bowling in conversation with Stephan Moldzio and *CORAL* Magazine

Tom Bowling with his wife Tatiana (left), and daughter Maya (right).

Tom Bowling, a marine biologist and former commercial diver, is best known as the driving force behind Biota Marine Life Nursery, which is based in Airai on Babeldaob Island, the largest island in the Pacific nation of Palau. Biota produces fish and invertebrates for the marine aquarium trade but also provides fish for conservation and restocking purposes in Palau.

Bowling began his aquatics career in 1999 when he founded Ocean Oddities, a seahorse farm based in Australia, where he produced several new species for the trade. Following this, he went on to build and install public aquariums in Asia and Europe. In 2006, Tom and his future wife, Tatiana Sledzinski, moved to the Marshall Islands to manage and develop the Marshall Islands Mariculture Farm (MIMF) for ORA (Oceans, Reefs and Aquariums LLC). This was the couple's first experience in island living in the Pacific. While it was challenging, this was also Tom's initiation into the world of ornamental marine invertebrate aquaculture.

Bowling went on to build a small public aquarium in Coffs Harbour at the National Marine Science Centre in Australia, and then he spent a few years performing consulting work. He was disheartened to find that the only work he could get as a "marine biologist" was with environmental firms that were being paid by coal and gas companies to monitor and observe the destruction of marine environments. Being legally bound and unable to report or do anything about the destruction he was witnessing firsthand pushed Bowling to his moral breaking point, and was largely the impetus for the Bowlings to sell their house and give up their comfortable lifestyle in Australia. The Bowlings risked everything and relocated to Palau, where they were able to secure a lease for a small, vacant hatchery. Bowling founded Biota Marine Life Nursery and began culturing ornamental fish while also researching the culture of the Bumphead Parrotfish and other species of significance.

Bowling's business partner, a German philanthropist, gave Biota the financial support to expand and ready themselves for the growing interest in providing sustainable ornamental marine fish to the aquarium trade. Bowling now runs Biota and Biota Aquariums from Palau and oversees operations in the Hawaii and Florida facilities. In August 2019, Bowling was recognized by the Marine Aquarium Societies of North America (MASNA) with the Aquarist of the Year award, which highlighted his accomplishments and leadership towards a sustainable marine aquarium hobby and trade. *CORAL* Magazine sat down with Bowling to bring you the story of how it all started, what has been accomplished, and what might be coming from Biota.

***CORAL*: Tom, how did everything start?**

Tom Bowling: I grew up in Talara, Peru, and my father was an avid animal collector. We had all kinds of pets: monkeys, toucans, penguins, tortoises, and even piranhas! As a result, I have been keeping aquariums since I was a child and culturing marine fish since the age of 15. I worked in a pet store and witnessed the unnecessary loss of many freshwater and marine animals that

Aerial view of Biota Marine Life Nursery in Palau.

came from the wild. I began to study fish biology and I realized, based on their reproductive life strategy, that we should be breeding many of them instead of taking fish from the rivers and oceans. The day I bought my first car with earnings from breeding fish in my mom's garage, I was hooked for life. I went on to do a double major in marine biology and aquaculture at James Cook University.

CORAL: **What do you see as the benefits of captive-cultured fishes, in contrast to wild fish caught from the reef?**

TB: Tank-raised fish are very well adapted to aquarium life because they are raised in the same conditions. They eat prepared foods and have minimal parasites and diseases. You can be confident they are not caught with cyanide, they have a low mortality rate during shipping, and they live longer because they're young when you first acquire them. Our animals are essentially domesticated, so they are perfectly happy in an average aquarium because that is how they were raised.

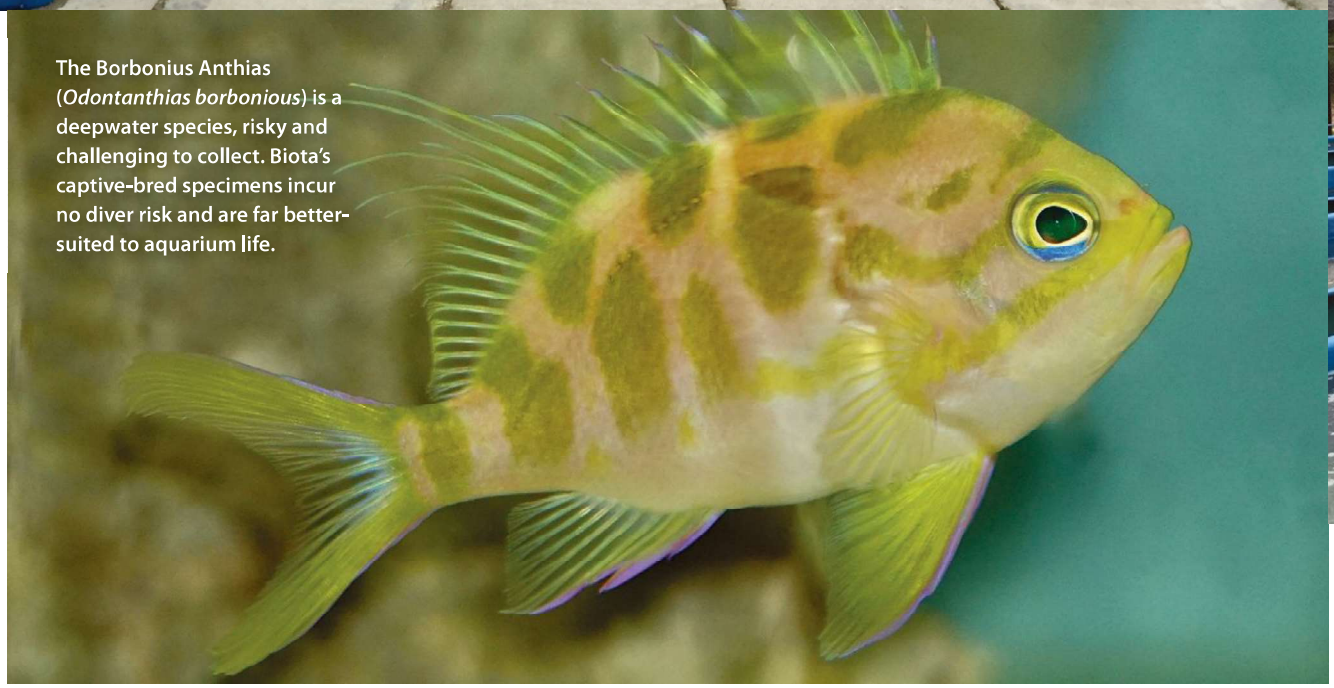
The Mandarin Dragonet (*Synchiropus splendidus*) is the perfect example. It's our flagship species and it clearly demonstrates what we are all about: wild-caught mandarins have a high mortality rate, they are hard to feed, and they often fail to adjust to aquarium conditions. Our captive-bred Mandarins come with a guarantee that they will eat pellets. They are grown in high densities and, as a result, are not as aggressive with each other as wild mandarins tend to be. We now produce F2 Mandarins (offspring of parents hatched and raised in captivity), and we can see the difference in feeding behavior. They will eat pellets from the surface!

Captive-bred Green Mandarins, *Synchiropus splendidus*, have become a staple offering from Biota.

CORAL: **So far you have been exporting your fish, corals, and invertebrates mainly to the U.S. market. But we've heard that you're planning to dive into the European market, too?**

TB: We completed our first export to the Netherlands in April, 2019. Biota Yellow Tangs (*Zebrasoma flavescens*) and Mandarins (*Synchiropus splendidus*) are now in the U.S. and the EU. Biota is funding the ongoing research and production of Yellow Tangs at the Oceanic Institute of Hawaii Pacific University, and we also have our own small facility in Hawaii, which is where we are focussing

Coral culture raceways utilize low-hung artificial lighting to help prepared corals for life in a home aquarium.



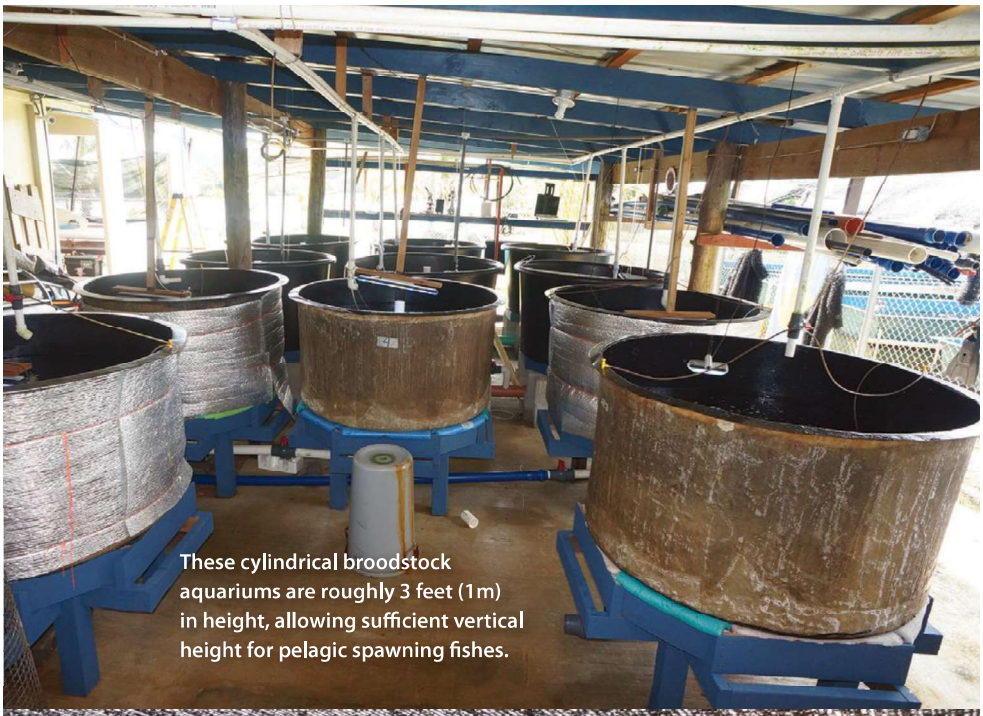
The Borbonius Anthias (*Odontanthias borbonious*) is a deepwater species, risky and challenging to collect. Biota's captive-bred specimens incur no diver risk and are far better-suited to aquarium life.

on other tang species, along with other fish like Potter's Angels (*Centropyge potteri*) and some secrets that we hope to announce soon.

CORAL: **You collected the deepwater Blotchy or Borbonius Anthias (*Odontanthias borbonius*) by use of gillnets during a technical dive at around 325 feet (100m) depth and raised this species as a world's first. What was the critical point that led to success?**

TB: Scientists with the California Academy of Sciences collected these fish on rebreather for us. We started with six subadults, which we raised to adult size. We have produced several thousand over the last year and hope to produce many more soon.

Interestingly, the larvae have huge ventral spines. They are voracious feeders and are a little aggressive during the pelagic stage, which means that we probably lose some during their early development. They become quite



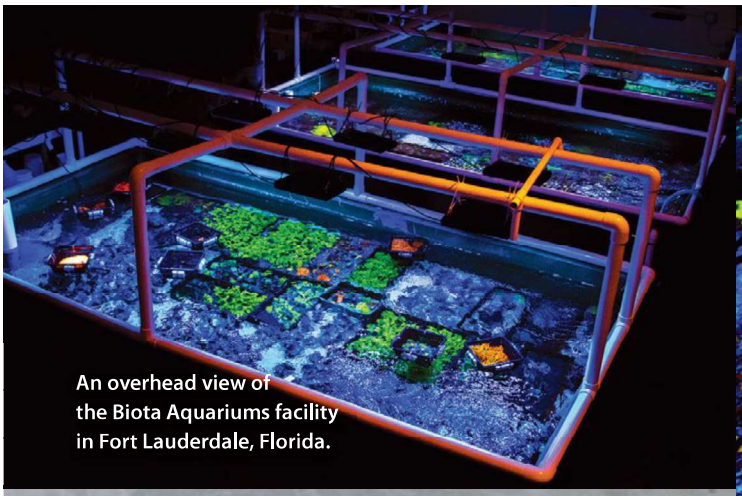
These cylindrical broodstock aquariums are roughly 3 feet (1m) in height, allowing sufficient vertical height for pelagic spawning fishes.

Shade cloth overhead helps create ideal lighting levels for these growout raceways which are utilized for both clams and fish.

territorial as they mature but maintain relatively small territories. We have raised them in high densities with no issue.

The response to cultured Borbonious Anthias at the Marine Aquarium Conference of North American (MACNA) in 2018 was exciting; one of my favorite things about the industry is the passion hobbyists have for their animals.

At the 2019 MACNA in Orlando, FL, we will be showcasing our *Genicanthus melanospilus*. We have a harem of these Swallowtail Angels in one of our big display tanks in Palau, mixed with other angels. Last month we raised a batch of eggs we collected from the tank, and we thought they were our usual angel—Coral Beauties (*Centropyge bispinosa*). It is always a gamble when you have mixed angelfish species in one system, as their eggs look very similar; it wasn't until 40 days later, in the grow-out tanks, that we realized we had reared a new species at Biota, and as it turns out, it was a species no one has ever bred before.



An overhead view of the Biota Aquariums facility in Fort Lauderdale, Florida.

Captive-bred Coral Beauties, *Centropyge bispinosa*, another routine offering from Biota.

Aquacultured Palauan corals await their final homes in the raceways at Biota Aquariums in Florida.

CORAL: What about their diet and specific needs?

TB: When it came to rearing these *Genicanthus* angels, it was very much the same as most fish: rotifers, copepods, and ***Artemia***, an abundance of food, and good water quality. Nutritional profiles are important, and this is where enrichment of these live feeds becomes the critical component to getting a big batch of "difficult" species through to settlement. Most marine aquarium species have similar but varied requirements. Life history dictates whether we get hundreds of eggs a day, such as from the Mandarins in Palau, or thousands of eggs per day, like the Yellow Tangs produce in Hawaii.

Most larval fish follow a similar development pattern. The secret to rearing good larvae is to produce the right-sized food at the right time with the right nutrition; it's not an easy task.

First, we have to grow the live algae for the plankton to eat. We usually, like most of the marine aquaculture industry, use *Isochrysis* and *Chaetoceros* spp. In Palau, we have two areas committed to phytoplankton production. When the algae has reached a sufficient density, it is moved to our live feed culture area. Here we have two systems of copepods and rotifer cultures.

Larval fish usually require their first feeding to be a small species of nutritious plankton (we use rotifers), and they quickly grow and move on to other planktonic species, such as the copepods and *Artemia* that we raise at the facility. The fish generally take 35–40 days to reach settlement. Once they undergo metamorphosis, we move them to grow-out systems. Some fish, like angels, can be handled earlier than this, prior to settlement. After settlement, they become much easier to feed, and that is when we try to get most species acclimated to eating prepared foods such as pellets.

CORAL: Do you have other deepwater species in the pipeline?

TB: This year we were lucky enough to have Dr. Richard Pyle, Brian Greene, and Joshua Copus visit us in Palau. They, along with the rebreather dive crew based here, helped us collect some deepwater angelfish species. As a result, we are now working with our first pair of Abei Angelfish, *Centropyge abei*.

Another favorite of mine is the Colin's Angel (*C. colini*). I am particularly excited about these, as they are almost exactly the color of the Palauan flag. I hope we can deliver these to market in the coming year; however, the fish that were collected are on the younger side, so they will take time to settle in, mature, and start spawning.

CORAL: Tell us about your different *Tridacna* clam species. How do you breed them, and which species do you supply to the market?

TB: We currently produce *Tridacna maxima*, *T. squamosa*, *T. crocea*, and *T. derasa*. Last year we also created a hybrid, *T. maxima* crossed with *T. squamosa*—we called it *Tridacna* "Mimosa."

BIOTA SPECIES LIST 2019

FISHES

Mandarinfish	*Synchiropus splendidus*
Coral Beauty Angelfish	*Centropyge bispinosa*
Old Glory	*Koumansetta rainfordi*
Link's Goby	*Amblygobius linki*
Pajama Cardinalfish	*Sphaeramia nematoptera*
Bristle-tail Filefish	*Acreichthys tomentosus*
Striped Blenny	*Meiacanthus grammistes*
Yellow-tail Blue Damselfish	*Chrysiptera parasema*
Bluegill Longfin	*Plesiops corallicola*
Golden-lined Spinefoot	*Siganus lineatus*
Forktail Blenny	*Meiacanthus atrodorsalis*
Yellow Prawn-goby	*Cryptocentrus cinctus*
Starry Goby	*Asterropteryx semipunctata*
Borbonius Anthias	*Odontanthias borbonius*
Clown Triggerfish	*Balistoides conspicillum*
Yellow Tang	*Zebrasoma flavescens*
Sailfin Snapper	*Symphorichthys spilurus*
Swallowtail Angelfish	*Genicanthus melanospilos*
Blotched Anthias	*Odontanthias borbonious*
Square Spot Anthias	*Pseudanthias pleurotaenia*
Pygmy gobies	*Trimma cana, T. milta,* and *T. tauroculum*

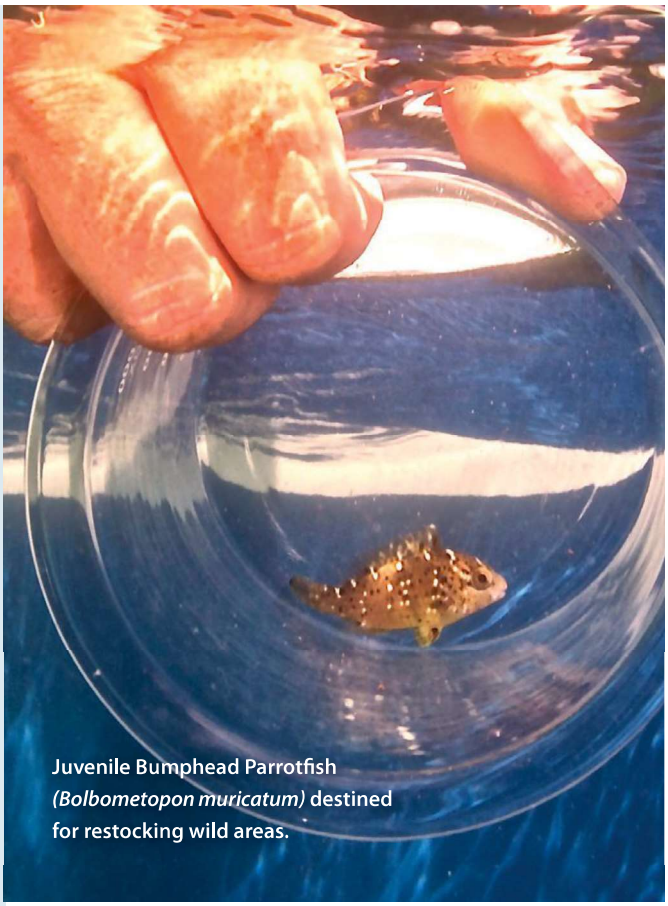
CORALS

Watson's Alien Hands	*Sinularia* sp.
Green Nepthea	*Nephthea* sp.
Palau Green/Fingerleather	*Sinularia* sp.
Toadstool	*Sarcophyton* sp.
Fingerleather Coral	*Sarcophyton* sp./*Lobophytum* sp.
Zoanthids	*Zoanthus* sp.
Mushroom corals	*Discosoma* sp./*Rhodactis* sp.
Star Polyps	*Briareum* sp.
Ricordea Coral	*Ricordea yuma*
Gorgonian Coral	*Hicksonella* sp.
Capnella	*Capnella* sp.

CLAMS

Fluted Giant Clam	*Tridacna squamosa*
Noah's Giant Clam	*Tridacna noae*
Boring Giant Clam	*Tridacna crocea*
Small Giant Clam	*Tridacna maxima*
Smooth Giant Clam	*Tridacna derasa*

Note: Corals are asexually propagated to F3s. Clown Triggerfish and Sailfin Snappers are raised from gametes collected in the wild; all others spawned in captivity.



Juvenile Bumphead Parrotfish *(Bolbometopon muricatum)* destined for restocking wild areas.

It was an interesting experiment to mix the eggs and sperm of different species of giant clams. We failed many times, and it wasn't until we managed to see good fertilization by tweaking the ratios that we had enough viable offspring to attempt it. Inspired by our research and success, we are now regularly mixing species and gauging the results at about two or three days post-spawning before deciding to put a batch of hybrids down.

The feedback on our Crocea Clams has probably been the most encouraging, and I think we will focus on these beauties simply for their coloration. I was hoping to find a colorful variant of the Teardrop Clams (*Tridacna noae*) that we bred last year, but so far we have only found one Blue Teardrop in Palau.

CORAL: **Palau is famous among divers for the mass spawning of reef fishes, e.g. Bumphead Parrotfish (*Bolbometopon muricatum*) during the new moon. BIOTA has leveraged these epic spectacles to collect fertilized eggs and raise the larvae of this large and endangered species in order to release them into the will in the Pacific islands, on reefs and regions where they have become locally extinct due to overfishing. What is the current status of your Bumphead Parrotfish Project?**

TB: Collecting wild gametes is a new and exciting method I developed in 2012; it was nicknamed "The Bowling Method" by my colleagues. I am certainly not the first to collect gametes from the wild, but I don't think anyone has targeted a specific wild fish spawning aggregation and then raised hundreds (or

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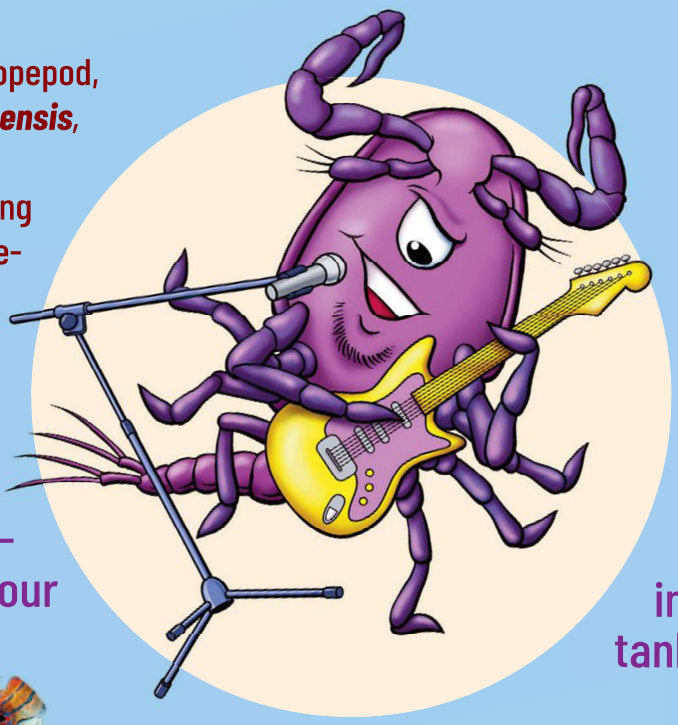

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"Wild collection can be done sustainably, but enforcement is the problem. When fishers leave 50% of the reef alone, the other 50% becomes a reliable supply of both food and aquarium species."

thousands) of that fish in a hatchery. In this method, you need go into the ocean and wait for the fish to spawn and then collect the gametes on location. It allows us to get eggs from many species that are probably impossible to breed otherwise. Collecting fertilized eggs from the wild has a minimal effect on the population of the target species because the percentage of egg survival in the wild is extremely low. By harvesting the eggs (gametes), we are having little to no effect on wild populations. We also do not need to remove wild breeders from the ocean. Collecting wild spawn is a demanding task, especially when working with new species. I have spent over four hours sitting on the bottom at 60 feet (18 m) on my rebreather, waiting for them to go off.

The Bumphead Parrotfish is a unique animal for us to culture; the larvae are very small, and they require a specific feeding regimen which took us four years to develop. We are able to produce them in high numbers now, and we are building a dedicated facility for this species for both sustainable food security and conservation through reintroduction to Pacific nations where they are now extinct.

CORAL: **After the passage of several conservation measures in the past, in 2015 Palau declared itself the world's first countrywide marine sanctuary, covering more than 500,000 square km (over 193,000 square miles) of ocean territory. Can you explain the importance of such a governmental conservation effort, and what do you think could be still improved?**

TB: Palau is leading the way in environmental stewardship and action in the Pacific; it's one of the few countries that took it upon themselves 25 years ago to protect species like the Bumphead Parrotfish (*Bolbometopon muricatum*) and the Napoleon Wrasse (*Cheilinus undulatus*). As a direct result of these actions, we can now go diving and reliably witness the spawning aggregations of these species in massive numbers.

Marine conservation still has a way to go, but the fact that Palau plans to stop large-scale commercial fishing and over-harvesting is an incredible start. I think the next thing that Palau needs to do for serious, long-term conservation is protect the reef fish populations. Currently, the marine sanctuary is focused on pelagic waters only; this is great for long-term food security, but Palau depends on tourism, artisanal fisheries, and all things reef-related. I know they are considering putting more size limitations on important reef-fish species.

Wild collection can be done sustainably, but enforcement is the problem. When fishers leave 50% of the reef alone, the other 50% becomes a reliable supply of both food and aquarium species. I would love to see this implemented more effectively for wild-sourced animals. Many collectors are in remote areas, and they can take from wherever they want without regulation. This needs to change.

Wild collection in the marine aquarium industry will always have a place, but it is up to the discerning hobbyist to make the choice to support the best options they have available. Biota supports sustainable methods regardless of the source.

CORAL: **In 2018 you completed your new BIOTA Visitor Center. What can people expect when touring your aquaculture facility?**

TB: Biota's Palau-based location is now open to the public. Our introduction video demonstrates the facility and how to get there if you come to Palau. We regularly have school groups visit, and we are involved in breeding and regularly releasing rabbitfish (the Golden-lined Spinefoot, *Siganus lineatus*), a favorite food fish here in Airai. We are passionate about being a minimal-impact business, and we can proudly claim to be one of the very few sustainable exporters from the Pacific!

Going forward, we plan to expand to new facilities as the species-specific science gets fine-tuned and we recruit staff who share our vision. We see an environmentally conscious shift in all hobbies and lifestyles, and we believe that Biota fits perfectly into educated, progressive, and science-based households of the future.