

# Not Just a FAD

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Photos courtesy of Sam Balderson,  
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— *Saving the Reefs in the Seychelles Islands*







LUCY MARTIN

School of small fish shelter under a fish aggregating device or FAD (above)

**Drifting fish aggregating devices (dFADs) are threatening endangered marine species and coral reefs in the Indian Ocean. Marine conservationist Lucy Martin worked with the Island Conservation Society (ICS), a non-governmental organization in the Seychelles, on a large survey in 2015 to find out how big an issue FADs actually were. The instruments littered the marine environment in the Outer Islands especially around Desroches, Poivre, Saint Joseph, Cosmolédo, Farquhar and the Alphonse Group, where Martin lived. As a trained marine biologist, she took a scientific approach to the survey and spent time in the water to see the damage for herself.**

As I descended, I saw a mass of netting twisting around and down. The visibility was excellent, but all I could see was bright, disorientating violet, punctuated by the dark black mesh of nets—my only reference. The deeper I went, the clearer the picture became. I saw sheets of netting, splayed out and smothering the coral life on the seabed below. I looked further and saw that this was going to be a big job. The lines of rope and broken fishing net extended towards the drop-off of the second, deeper plateau.

As I approached, I checked my computer's no-deco limit and assessed the complexity of this particular case. I saw the main anchor point was wrapped around a large coral bommie, but it looked fairly fresh and uncomplicated. So, with eight minutes of bottom time left, I decided I could go a bit farther and try to remove the whole hunk of debris before me.

It was a fairly simple task until I had shallowed up. There, the netting was carefully woven around arms of branching coral. Some I patiently picked off, allowing the slight surge to swing me away and then



CHRISTIAN BURGER

back to my starting point to continue my mission. Other parts would take too long, and coral had already started to overgrow. So, I reached across my torso, releasing my knife from its holder, and sawed the net on either side.

Slowly but surely, my dive buddy and I—each working on our own complex puzzle of netting—got the whole monstrosity free from the reef. Once we started to roll up all the rope and net together, we realised that this was far too heavy for us to swim up to the surface. My buddy pulled out a 30kg lift bag, and we bound the bulk of rope together. After a couple of purges of the octopus into the lift bag, it sailed to the surface. Several minutes later, so did we, breaking the surface next to a wooden raft covered in goose barnacles.

As we waited for our pick-up, I noticed many small fish hanging in the dark beneath the shade cloth that was stretched across



VIDEO STILL COURTESY OF LUCY MARTIN

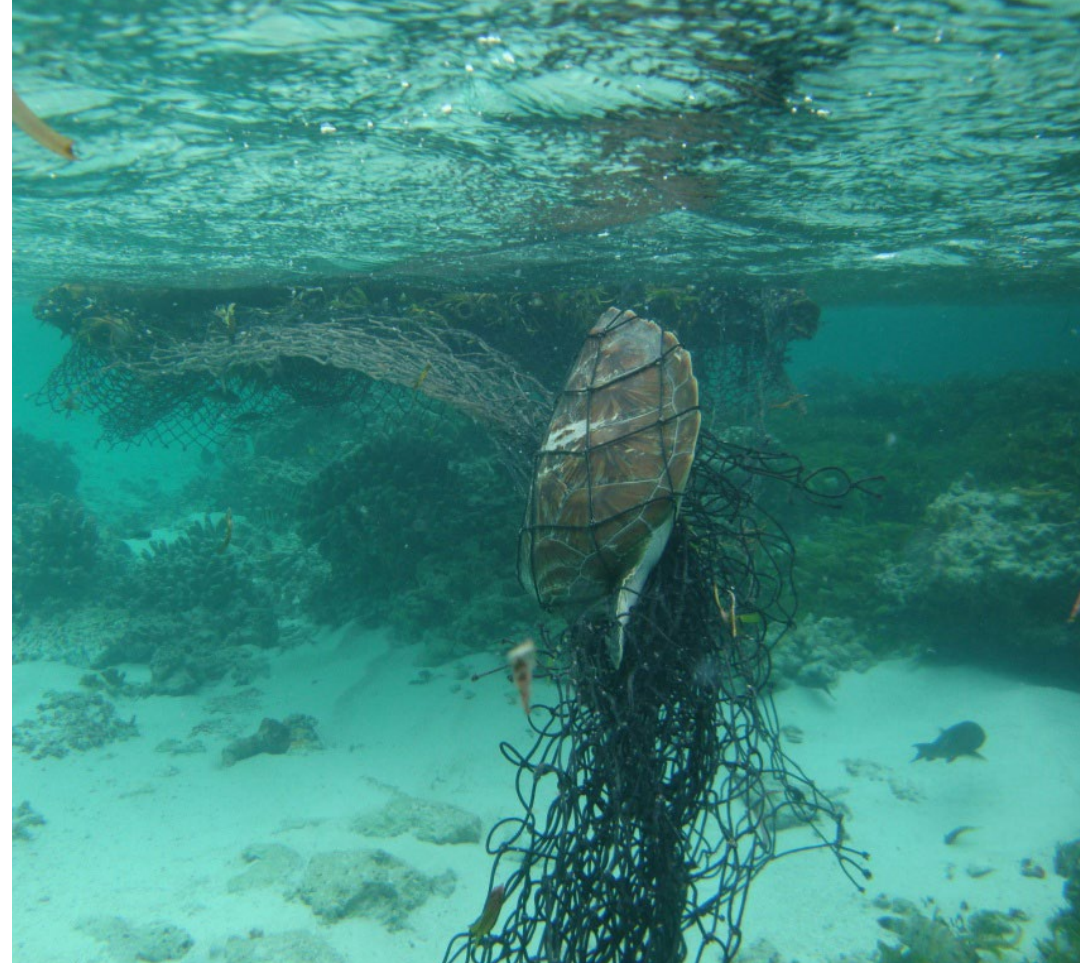
Divers use a lift bag to bring heavy FAD materials to the surface for pick-up by a dive boat (above); A diver cuts lose a FAD tangled in the reef (top right and previous page)



Dead green sea turtle, which got entangled in a FAD and drowned just inches from the surface where it could have reached air to breathe



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ICS

Abandoned FADs will drag on reefs and seagrass, destroying critical habitat along the way

the raft—some juvenile triggerfish and needlefish. When the boat arrived, we heaved and hauled, trying to lift the heavy load aboard. Many shouted instructions and directions later, we finally retrieved the dFAD out of the water. We perched ourselves and our dive gear around it in our small boat, as the skipper accelerated towards the next removal mission of the day.

### What are dFADs?

A typical dFAD is a two metre by two metre raft made of bamboo, polyvinyl chloride (PVC) pipes or even galvanised steel. The raft is typically tightly bound with layer upon layers of old fishing net or shade cloth. Within the binding, roughly six hard plastic or plastic foam buoys are attached to provide extra buoyancy to the raft. Underneath the raft, there is an aggregator of some sorts, typically hanging net or rope with woven plastic sacks tied at intervals.

The longest aggregator I ever pulled out of the water was 50m long. All of these dFADs were used in the industrial

purse seine (PS) tuna fishing industry. PS nets, which are long and trapezoidal, are dragged in a circle around schooling tuna. Once filled with tuna, they are closed at the bottom and everything is hauled aboard. The biggest PS vessels use nets that are 2km long and 300m deep, and quite frequently will capture non-target bycatch like whale sharks, silky sharks, sea turtles and manta rays.

Whilst this technique has been used on free schools of all types of fish for centuries, the use of dFADs really took off in the early 1990s when the yellowfin tuna fisheries in the Atlantic collapsed. Tuna fishing moved to the Indian Ocean, but the deep water posed a challenge to finding fish.

Natural FADs, such as tree logs or palm leaves, have long been known by local fishermen to have tuna aggregating around them. Any floating object in the open ocean provides shelter and refuge for small fish. Over time, small schools turn into bigger ones, and then, larger species arrive. After about five months, huge accumulations of tuna come to feed



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on the supply of food. The bigger the aggregator, the more fish. It was not long before businesses in the fishing industry started to manufacture their own (see Sidebar 1).

### Environmental impact

Back in 2015, I drove around Alphonse

atoll, considering the impacts of this multi-billion-dollar industry. When a dFAD goes out of range, it is simply abandoned, at a high cost to both the marine environment and the non-profit organizations that try to clean them up. Through the baseline survey in 2015, we found 210 dFADs stuck fast to the reef, seagrass flats or

### SIDBAR 1. A BOOMING TUNA INDUSTRY

Seeing huge potential, the purse seine (PS) tuna industries (Spanish, French, Seychellois, Mauritian and Korean) developed their own drifting fish aggregating devices (dFADs) with a floating buoy attached, which at first just housed a radio beacon. By the early 2000s, the beacon was replaced with real-time GPS units. Sophisticated acoustic fish finders on the buoys made it easy for vessels to know exactly what tonnage of fish were under the dFADs in specific locations. This made it easy to maximize their catch. Solar panels were then added to the buoy to extend the lifetime of a dFAD, allowing fishing grounds to expand, covering larger areas.

It was such a prosperous time that some nations even brought dedicated supply vessels into the fleet (the French banned the use of these boats) whose only job was to deploy and collect dFADs. Over the next ten years, dFAD use increased by 70 percent, with about 10,500 to 14,500 deployments of new buoys in 2013. This may seem exorbitant when one considers that each buoy costs around US\$1,500, but tuna fishing is a huge industry. In 2014, the global tuna industry was worth US\$33 billion. In 2017, PS vessels in the Western Indian Ocean caught more than 380,000 tonnes of tuna.

The majority of the tuna from the Outer Island of the Seychelles is landed in Port Victoria, the capital, and is destined for the island's cannery or transshipment. In 2015, the country exported over 30,000 metric tonnes of canned tuna, valued at more than US\$223 million and accounting for 50 percent of the country's exports. ■







Divers rescue endangered hawksbill sea turtles entangled in FAD netting (above and right), washed up on beaches where sea turtles go to nest (below); Dead olive ridley sea turtle drowned when it was ensnared in FAD netting (left)



SAM BALDERSON

mangroves, and an additional four that were still drifting in deeper water.

The range of affected species and habitats is vast. The worst damage is being done by curtain net aggregators—an early form of dFAD—which poses a significant entanglement threat to sharks.

In 2013, silky shark mortality in the fishing grounds was estimated as 480,000 to 960,000 sharks per year. Once a curtain net reaches our coastlines, it has left the habitat of pelagic sharks but not the habitat of sea turtles.

### A cruel death for sea turtles

Fully aware of the threat of entanglement, I would jump into the water in snorkel gear every time I saw a new dFAD, with a sense of dread that I was going to see something terrible, and I usually did. I saw hawksbill and green sea turtles, and the only olive ridley sea turtle I had ever seen, suspended in the nets and no longer moving. Those usually graceful reptiles, with alert heads and bright eyes, were turned into lifeless

carcasses, with flippers limp at their sides and heads hanging down onto their carapaces in a timeless sleep.

On one particular dFAD dive, my mask filled with tears, when I came across another casualty. All that was left was a turtle's black skeleton, which was almost camouflaged among the masses of broken netting, just a metre below the surface—a metre from the air it so needed to breathe to stay alive.

### Reef destruction

Following an outcry from conservation groups, dFAD designs were encouraged in 2012 to avoid entanglement of sea turtles, and curtains were bound to form sausage nets. During our survey, 62 percent of dFADs used sausage nets; but once they hit the coastal environment and wrapped around coral heads, the binding ropes were cut, and the nets began to unravel over the reef.

This scenario is the most difficult to approach. On scuba dives, I have unpicked sheets and sheets of netting to free coral, countless times.

The longer the dFAD is attached to the reef, the more points become anchored to the reef.

I have navigated these messes as if penetrating a shipwreck, pulling myself this way and that along the main ropes to find the end point. I have seen many smaller coral colonies, which are not

strong enough to withstand the drag of the raft above, wrenched from their base and suspended in netting like a sad, abandoned bouquet of flowers in a graveyard.



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A diver removes a FAD caught on the reef.



Divers remove a drifting FAD and tow it to the dive boat for collection.

Some dFADs make it through the shallow reef break and enter the lagoon. I remember going to retrieve one and seeing the destructive trail of the long, slow journey it had made over the reef flats where it lay completely dry on a low tide. As the water level rose, it had moved, bit by bit, closer to the deeper lagoon, and I could see the drag marks stretching for hundreds of metres, carving through the seagrass beds, leaving a bright white trail behind it. The dFAD itself was heaving from the amount of sediment being carried with it and took three people to load into the boat.

### Danger for nesting endangered sea turtles

Occasionally, a dFAD gets across the flats into the deep lagoon where its journey to the beach is faster. One day, I was walking the beach and found a green sea turtle completely stuck in the netting. Alphonse is a haven for nesting turtles.

Many a time have I crouched in silence for hours, watching the miracle of life, as these enormous marine reptiles haul their bodies out of the water to lay eggs.

This particular turtle had just nested. In the act of trying to get back into water after all that labour, she had hauled her body into the net. Unable to move backwards, she had tried to turn to free herself, which had snared her further. Returning to the scene with a knife, I was able to cut her free and try to guide her exhausted and limp body back to the waters' edge.

### Enduring synthetics

By 2015, both curtain and sausage nets were beginning to be phased out by upcoming bans and a non-entangling dFAD was defined as having no net material at all. Despite that, 70 percent of all dFADs we found, at the time, were made of synthetic materials. Many of them were abandoned, still floating around the ocean

from the early days of their invention. They will persist in the environment for hundreds of years if things do not change.

The ICS mantra is to envision a future in which island ecosystems and associated wildlife are robustly protected for the benefit of all, and its mission is to promote restoration and conservation. But was enough being done? It did not seem that way to me. We, at ICS, wrote news articles within the Seychelles and a technical report of our findings, but I doubted whether anybody across the rest of the world knew about these issues.

Tuna are a highly migratory species, and institutional bodies called Regional Fishing Managements Organisations (RFMOs) bring together nations to better manage their fisheries. For the Seychelles, this is the Indian Ocean Tuna Commission (IOTC), and we hoped they would be concerned about what was happening in the Alphonse Group. So, we presented our

### SIDEBAR 2. FAD WATCH Text by Gail Fordham, ICS Conservation Officer

As a result of previous studies and greater public interest, a multi-stakeholder initiative has been under way between the Spanish Tuna Purse Seiner fishing representatives (OPAGAC), Seychelles Fishing Authority (SFA), Island Development Company (IDC) and Island Conservation Society (ICS). It is called FAD Watch and is the first project of its kind. Its goal? To prevent and mitigate dFAD beaching through an automated alert system.

The project is only possible thanks to participating fishing associations, like OPAGAC, who agreed to provide real-time information from the GPS on their dFADs. The system reports to ICS whenever a dFAD penetrates a five-nautical-mile buffer zone around the atoll or island ecosystems, and provides GPS coordinates, trajectory and estimated time of beaching. This allows staff time to plan and intercept dFADs before beaching occurs on Seychelles' coastlines.

OPAGAC has also provided funding for ICS to cover the costs of fuel, labor, equipment and project coordination through the duration of the program, which is still on-going. IDC provided support to ICS on the islands where dFAD removal was taking place, including the use of boats, skippers and tractors.

FAD Watch continues with ICS teams quantifying and characterizing the negative impacts on habitats and wildlife across the Seychelles. This pilot project has raised awareness of the issue and aims to encourage other fishing associations to join.

Going forward, FAD Watch plans to improve real-time tracking, which will result in quicker effective action and to work with stakeholders in the development of BIOFADs. Through FAD Watch, IOTC reductions in quotas and increased general public awareness, beaching of dFADs may now have reduced from around 10 percent to less than one. ■

CHRISTIAN BURGER

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Divers lift a dFAD onto a boat for proper disposal. Many are shocked to see the scale of the problem in the Indian Ocean.

findings to them at a conference later that year, in 2015.

### Divers help remove FADs

In 2016, I left ICS to set-up a PADI scuba dive and nature activity centre for Blue Safari on my same island home and created a suite of hands-on conservation activities for guests. That year, the ICS recorded an additional 109 dFADs, which beached. With further investigation, the ICS identified the Alphonse Group as the worst affected atolls in the region. I put weekly beach clean-ups on the hotel guest's activity schedule, so that they would see, first-hand, the impact of dFADs and help remove them. Staff regularly joined in the educational initiative and learned to appreciate the problem even more. Together with ICS, we removed 1.3 tonnes of beach debris in 2018.

Beach clean-ups have become

hugely popular globally, with a very active community across the Seychelles, including some massive projects run by the Seychelles Island Foundation and The Ocean Project. Whilst we see lots of floating marine debris at the surface in the Alphonse Group, mostly coming from Indonesia, the only synthetic trash underneath the waves, on our otherwise unspoilt reefs, are those dFADs from the tuna fishing industry. In addition to damaging the environment and its wildlife, they also pose a navigational hazard to our dive boats and are eyesores for divers who often inquire as to what they are.

I encourage all guests to get involved with a dFAD removal on one of their dives during their dive holiday. It is a recommended adventure dive for PADI Advanced students and the AWARE Dive Against Debris (DAD) is our most

popular specialty course. Our dive staff view dFADs as graves upon the reef, but it is usually when they do the course and remove the dFAD that they are really shocked about the scale of the problem.

Employees of the Island Development Company (IDC) who lease the island and manage waste are also exposed to the problem of dFADs through disposal considerations. Together, we decide whether the materials can be recycled or incinerated on the island or sent to storage to await shipment to the mainland on the next available barge.

Our dive groups are exclusively small, with less than eight divers per week. Despite this, we engage enough divers to remove just under two tonnes of dFADs in each eight-month season. The story does not end with removal. Part of raising awareness is recording the information and placing it on the

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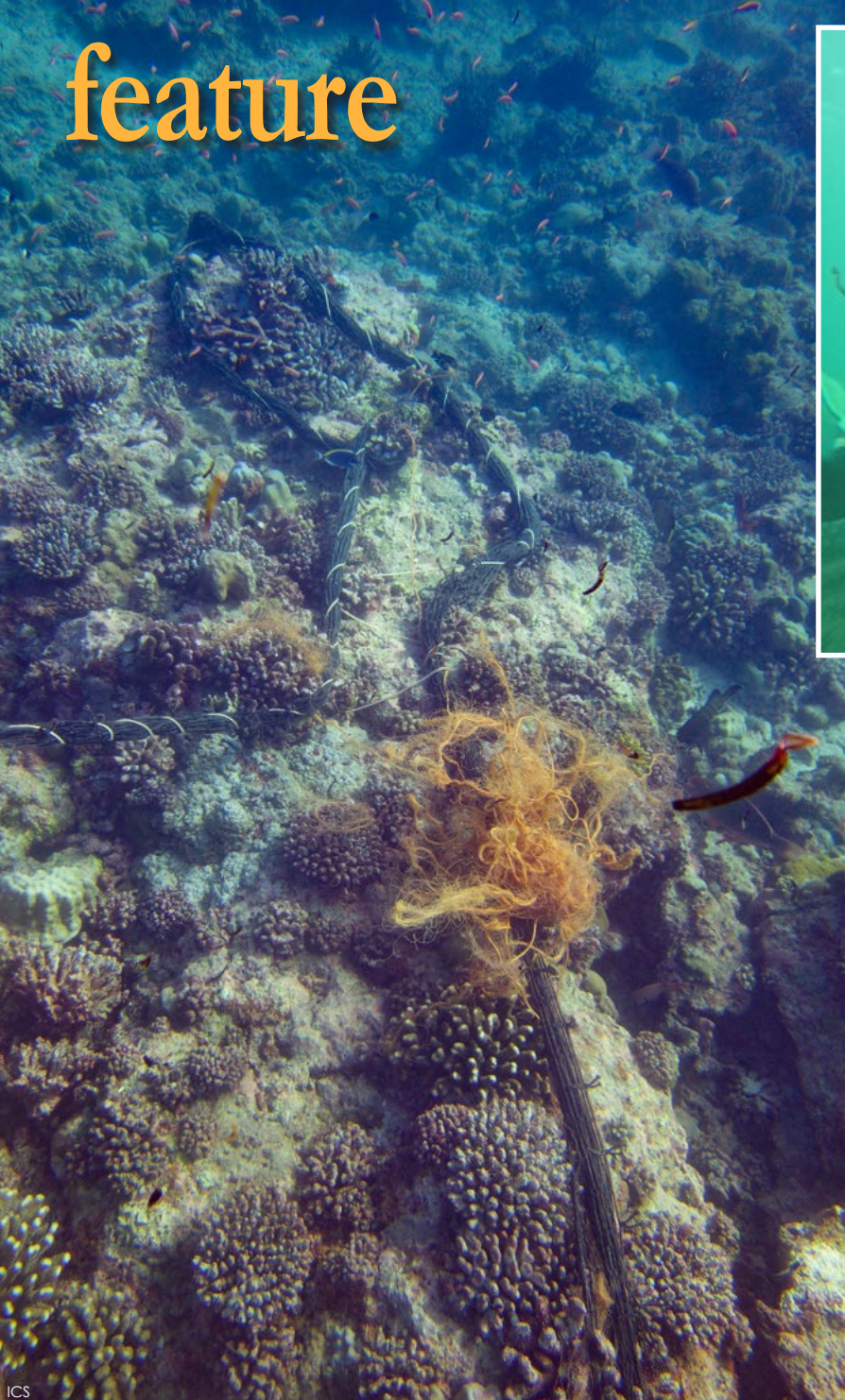
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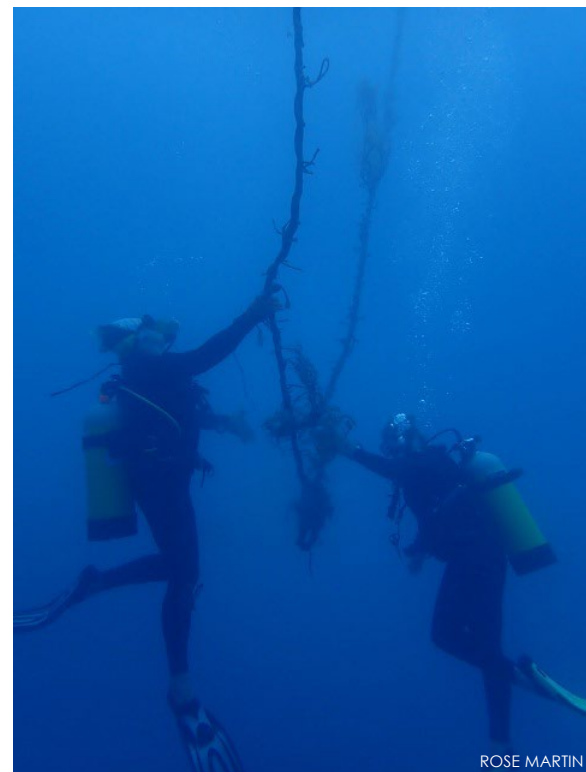
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ROSE MARTIN

THIS PAGE: Divers (above and left) work to remove FADs stuck on the reefs in the Seychelles Islands; A raft loaded with recovered FADs and debris (right)

## Recent FAD sightings

Last month, after strong winds blew new dFADs into the area, I headed out for a removal that was not one we had been alerted to by FAD Watch (see Sidebar 2). It likely belonged to a non-participating company. It was one of the newer non-entangling dFADs, with just a single long thick rope and ghostly white sacks tied to it

at intervals, flapping in the gentle current.

My heart sank when I saw a juvenile green sea turtle attempting to eat the sack, mistaking it for food, but at least the turtle was tangle-free and alive. This time, I had a whole entourage with me, because I was teaching an AWARE Dive Against Debris (DAD) course to hotel guests, willing to do their part in helping to protect the reef.

I have seen these new designs in deeper water lately, because the single ropes used by fishing fleets are very long. Luckily, several divers were on enriched-



air nitrox and able to dive beyond 25m, while others hung mid-depth, waiting to help coil the rope towards the surface.

The damage to the reef was minimal, but I noticed something I had been encountering more often of late. It was a smaller coral engulfed by the tiny ribbon-

like frays of plastic exposed from within the nylon rope. It was as though the coral had used its only defence and sacrificed its fleshy skin to cut the intruding rope with its limestone skeleton.

It took a long time to cut the frays free, but fortunately, there were enough of us

AWARE DAD website, putting the scale of our regional fishing-related pollution problem on the global map.

## Move to biodegradable FADs

Meanwhile, whilst my main focus switched to eco-tourism, ICS and the IOTC made advances at the policy level. A year after the baseline study, the IOTC placed the first-ever limits on the number of active dFADs permitted per vessel—350 per vessel per season, at the time of writing. A reduction of 9 to 12 percent in the contributions of dFADs to overall tuna

catch had also been recorded.

The IOTC has also recently called for further research into how the fishing industry can make the switch to using biodegradable material for dFADs (BIOFADs). To this end, the European Union is currently piloting a two-year project to assess the viability of the different materials and environmental damage by deploying 1,000 different BIOFADs. So far, the efficiency of these rafts is minimally less for the fisheries, and there is hope that we may soon see a move towards naturally-made dFADs.

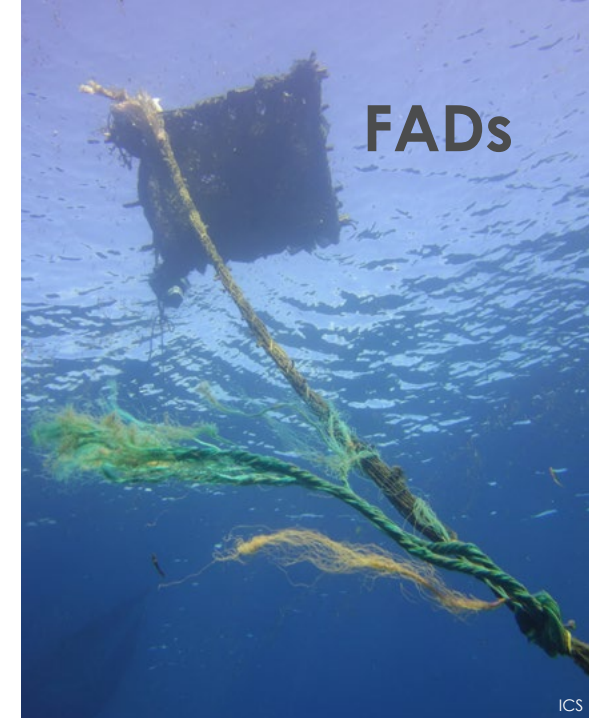




BRANDI MUELLER



BRANDI MUELLER



FADs

ICS

Life under a FAD (left)—barnacles grow on the lines and dozens of golden trevallies shelter under the device; A beautiful beach on Alphonse Island in the Seychelles (above); One of the FADs found abandoned and drifting in the waters around the Seychelles (top right); Divers work to remove drifting FADs caught on the reef around Alphonse Island (right)



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to clear it before our air ran out. As the other divers climbed back aboard the dive boat, it occurred to me that coral reefs will still need the technical expertise and time of scuba divers to defend them from dFAD invasions for some time to come. I can only hope that less and less of these devices enter the ocean, that more companies join FAD Watch, and that BIOFADs finally do come into play.

I have always believed that throughout history, progressive changes in society have only been successful when humanity pulls together. It seems like this is happening in the Seychelles, although the oceans may need a louder voice. So, I will continue to tell the dFAD story and bring the scuba divers I encounter into action. ■

*Lucy Martin, a passionate and experienced marine conservationist from England, is a PADI Master Scuba Diver Trainer and holds a graduate degree in marine biology. She has been living on Alphonse Island in the Seychelles for the past six years and manages the Blue Safari activity centre. Martin personally*

*thanks Greenpeace for initially supporting her work on dFAD removal.*

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