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GREEN FINS

ENVIRONMENTAL BEST PRACTICE FOR ANCHORING GUIDELINES

Mooring Buoys and Other Alternatives to Anchoring

UN environment programme

THE REEF-WORLD FOUNDATION

FOREWORD

Reef-World, the team behind Green Fins, has created these guidelines to help Green Fins members reduce the harm they cause marine environments through anchoring. These recommendations are a consolidation of known best practice around the more environmentally friendly alternatives to anchoring. They also outline how to drop anchor with minimal damage to the ecosystem if anchoring must take place. This document focuses only on the environmental aspect of anchoring practices so please follow recommendations from relevant maritime authorities for guidance and due diligence around health and safety, liability etc. Please also be sure to tailor any guidance outlined here to be suitable for the size and weight of your vessel and the depth of the mooring site.

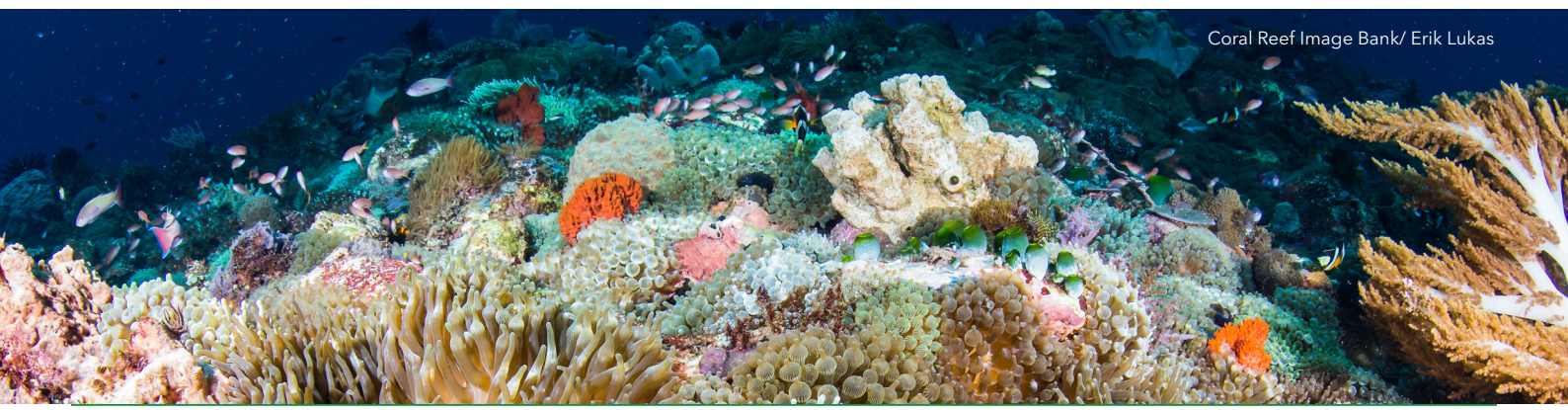
It's no surprise that the top reef-based diving destinations also house some of the most biodiverse coral reefs in the world. From the Great Barrier Reef to Hawaii, the Caribbean to the Indian ocean and, of course, the Coral Triangle, reefs all around the world have been impacted by anchors. In the Coral Triangle alone, nature and adventure-based tourism is forecast to be worth up to US $1.46-US $1.88 trillion per year by 2035. This outperforms mass tourism by 60-65% on average and brings socio-economic and environmental benefits to over 105 million people.

But it is known that coral reefs have been negatively affected by intensive recreational diving pressure. Anchoring is one practice where dive operators have the power and influence to prevent severe long-term impacts. Although anchoring has been a regular part of the scuba diving and snorkelling industry, we need to act now to ensure that anchoring practices are not harming the very environment tourists come to enjoy.

This guide gives an overview of different alternatives to anchoring. The most suitable solution for your situation will vary on the location, context and infrastructure of the site so, while there is no "one size fits all" solution, there are a diverse range of options for you to choose from. We understand that, in some instances, anchoring can be the only option. So, this document also includes guidelines on how to drop anchor in a way that minimises any negative environmental impact (for example, through coral / marine life contact or dragging).

Thank you for helping us protect our precious coral reefs by adopting more sustainable tourism practices.

THE REEF-WORLD FOUNDATION | GREEN FINS INTERNATIONAL COORDINATOR



Coral Reef Image Bank/ Erik Lukas

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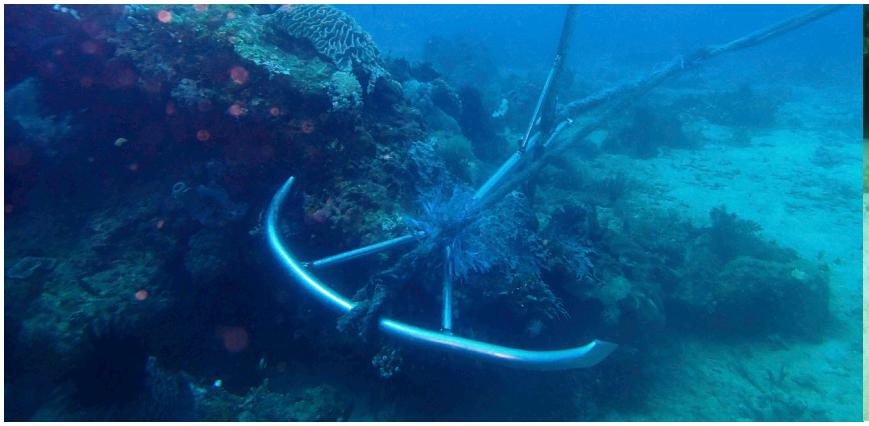
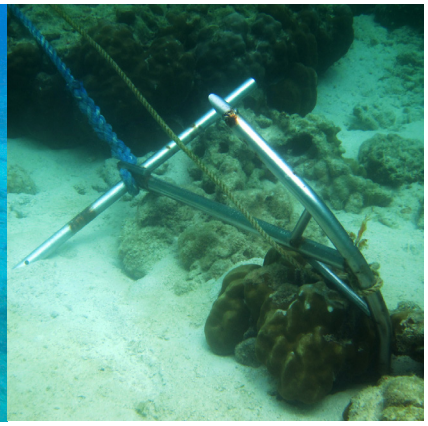
ANCHORING & THE ENVIRONMENT

The environmental threat

Anchors are heavy and often have a long chain attached. When dropped onto a fragile coral reef, they cause great destruction.

All contact between anchors and the organisms living in the bottom of the seabed results in physical damage, dislodgement or increases in sedimentation. If done incorrectly, damage can occur during the placing, retrieval and while at anchor.





In addition to the anchor being a hazard to the environment, the cables and chains can also increase the damage. Even if the anchor is carefully placed, the cable can stay in contact with the reef. If the wind or current causes the boat to change direction, the anchor and chain will drag and cause even more damage to our valuable coral reefs.

The extent of the damage caused by anchoring will be affected by a number of factors, such as the number of boats, their size, weather conditions and substrate firmness. Even a small amount of damage can be devastating for coral reefs because corals are fragile and, often, slow growing animals. Did you know honeycomb coral takes up to 20 months to grow just 1cm?

An anchor can impact an average of 7.11% of the coral at a frequently used site each year. At this pace, it won't take many years to destroy any of our favourite dive sites.

The importance of minimising anchor damage

There are many different types of corals and anchoring affects all of the family groups. The extent of the damage can vary from complete to partial destruction and it can take a long time for reefs to recover from this damage:

- Soft corals: lack a hard skeleton and so are highly susceptible to physical damage
- Branching corals: are brittle due to the branching morphology of its calcium carbonate skeleton and so highly susceptible to damage.
- Massive corals: With their calcium carbonate skeleton, these have important reef-building qualities and are somewhat more resistant to physical damage than other types of corals.

Coral reefs are characterised by their tri-dimensionality. This means that ecological damage caused by anchors can considerably reduce the complexity of this marine habitat. Having fewer available homes for marine species to live in results in poorer fisheries, reduced coastal protection and less attractive reefs for tourists.

More than 450 million people live within 60km of coral reefs with the majority directly or indirectly deriving food and income from them. So, it's in everyone's interest to maintain healthy coral reefs for future businesses, tourism and livelihoods.

It's also important to minimise the direct pressure tourism puts on coral reefs because healthier reefs are better able to withstand wider global stressors. A coral reef subjected to regular physical damage (for example, from anchoring or diver contact) will be less resilient to the larger scale changes from a warmer, more acidic ocean. This may lead to more intense and frequent bleaching events.

There are many issues impacting reefs and, certainly, there are far bigger threats than running a dive shop. But by reducing the impacts you do have control over – such as using alternatives to anchoring – you are playing your part in helping to save our reefs by leaving them stronger and more resilient to global threats. Not to mention that coral reefs are one of the most valuable ecosystems on the planet. It is estimated that the replacement value of one square metre of coral reefs is US $3,000!

All marine ecosystems are connected and it's not just coral reefs that are affected by anchoring. Seagrass beds provide a nursery and home to many types of fish, molluscs and crustaceans. They often receive little attention but they are some of the most productive ecosystems in the world. It's been estimated that the world's seagrass meadows can capture up to 83 million metric tons of carbon each year. Anchoring can devastate this fragile marine ecosystem in just seconds.

Recommended solutions

You can prevent immediate and visible damage to marine ecosystems by following best practice and using alternatives to anchoring wherever possible. The most suitable solution for your situation will vary on the location, context and infrastructure of the site so, while there is no "one size fits all" solution, there are a diverse range of options for you to choose from.

Though solutions may differ, the successful use of alternatives to anchoring across different locations boil down to one theme: collaboration between tourism businesses, government and the local community.

Here are a range of environmentally friendly alternatives to anchoring for you to consider:

- **Use mooring buoys:** mooring systems provide permanent lines that allow boats to fix their position without dropping an anchor

- **Attach to moored boats:** Morning buoys can often support more than one boat. Research the tonnage that your mooring buoys support and remind your staff that they can moor to other boats if possible.
    - Remember to make sure that, by attaching to the moored boat, you do not exceed the total weight allowance of the mooring buoy.

- **Moor to a pier:** This will not affect marine life and is convenient for loading and unloading the boats. Floating piers can be constructed with minimal damage to the environment and may be installed and removed seasonally if necessary.
    - Make sure the floating pier is installed in an area where it is not blocking sunlight to coral reefs or seagrass.

- **Moor to a beach mooring line:** to secure boats at the shore, permanent mooring lines can be installed from the beach to a fixed mooring beyond the wave break zone

- **Drift:** Dive sites with strong currents are better suited to drift diving. Not having to drop anchor will prevent any risk to the marine environment.

- **Install mooring buoys:** Be a role model! Install your own or offer your support to relevant local authorities. Please always seek permission or authorisation before installing any moorings.

- **Install reef markers:** Reef protection markers or buoys are placed on the surface at strategic positions, showing where the cover of coral reef is low and there's a sandy bottom. Boat operators line up two markers and drop their anchors seaward (only) from the imaginary lines between the markers.

If anchoring is absolutely necessary, the boat crew should make sure they are in designated areas away from important ecosystems and where anchors will not be dragged near these areas or accidentally cause damage.

INSTALLING AND MAINTAINING MOORING BUOYS

If there are no other alternatives available and there is a need to install mooring buoys, here are two approaches that could be adapted based on the environment in which you are mooring. When choosing a mooring site, please consider tidal range, wind direction and strength and currents. This will determine the equipment needed. Mooring buoys do still have an ecological impact but will lead to far less damage compared to regular anchoring on the site. Please be aware of the potential risk of megafauna entanglements and mitigate this where possible by making sure there are no excess loops or lengths of rope in the mooring.

Installing a mooring buoy is one of the most effective ways to avoid the damage that occurs to sensitive marine habitats through anchoring. Your first choice for installing a mooring should be permanently attaching to the substrate. For example, drilling into solid rock (where this can be done with minimal damage to life on the seafloor). These permanent moorings, sometimes known as the Halas Mooring System, will last longer and have a lower probability of impacting the marine environment during heavy storms.

However, in many cases, the equipment needed or composition of the sea floor prohibits the use of this mooring method. For this reason, we have outlined two practical alternatives. To install a mooring buoy, please use the following steps as a guide. Remember, these may vary depending on the size of your boat and where you are installing the mooring:

- **Installing mooring buoys for small boats (speedboats, outrigger boats etc. for approx 6 people**
- **Installing mooring buoys for large boats (large day boats approximately 43 foot/13m)**

INSTALLING MOORING BUOYS FOR SMALL BOATS (speedboats, outrigger boats etc. for approx 6 people)

To build and install inexpensive yet long-lasting mooring buoys, please follow these steps:

MATERIALS:

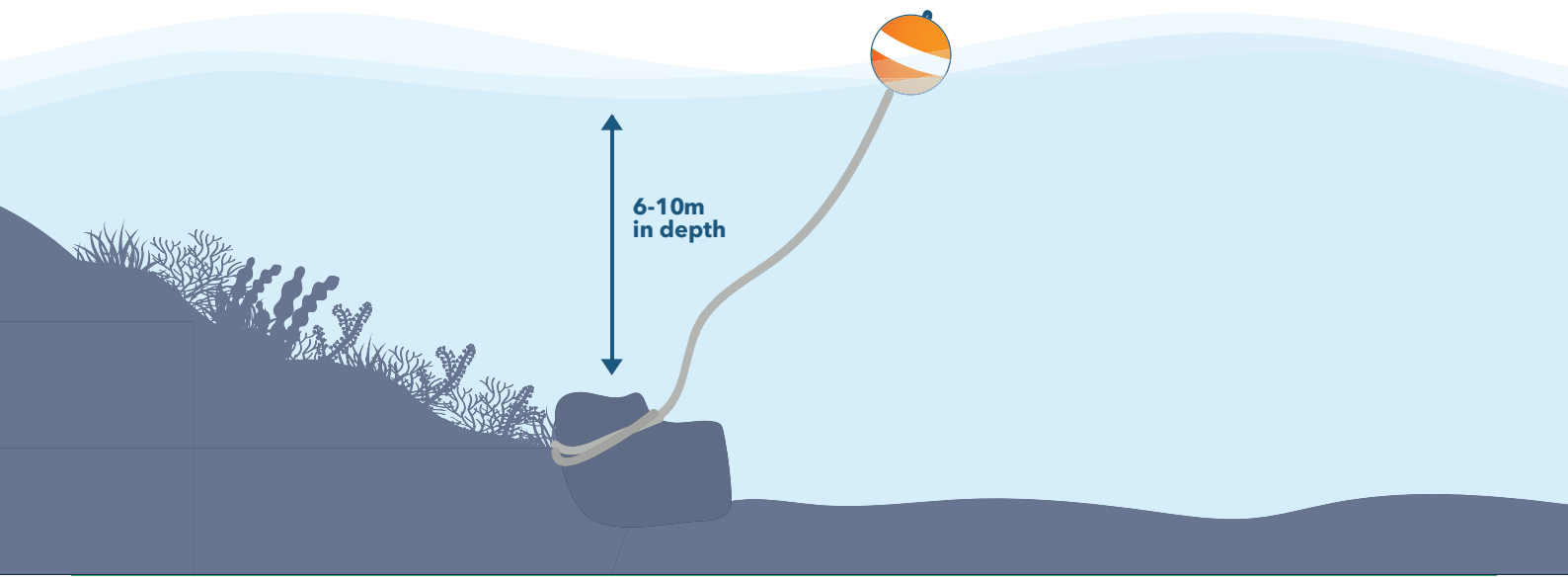
- **Tyre-rope:** A strong, durable rope-like material can be made from old car tyres sliced into strips (4-5cm wide x 10-15cm long). This is a good alternative to rope and allows you to upcycle car tyres in the process too!
- **The buoy:** Old canisters, water tanks or anything that floats and has somewhere a rope can be attached to can be used as your buoy.
- **Rope:** You will also need 1-3m of rope which will tie the buoy to the tyre rope
- **Nylon string**

HOW TO ATTACH THE BUOY TO THE REEF

Attach your buoy to the reef without causing damage by following these steps:

1. Attach your buoy to the 1-3m length of rope
2. Find large rocks or boulders along the reef slope that have minimal marine life growing on them
   a. The rocks should be approximately 6-10m in depth
   b. If the bottom is sandy, and there are no rocks or boulders, you can create your own weight by making a concrete block with a steel ring or filling a wooden crate with rocks
   c. The size and weight of the rocks/blocks will depend on the boat size. Ideally, two blocks should be connected to each other to prevent drifting
3. Feed the tyre-rope around the rock and tie it off securely
4. If needed, use the nylon string to help hold the knots in place
5. Make a loop at the other end of the tyre-rope and attach your rope and buoy/float
6. Add an additional rope tied to the buoy with a loop at the other end (for crews to connect their boat)
7. Make sure you check on your mooring regularly and undertake maintenance to prevent any wear-and-tear

Make sure there are no excess loops or lengths of rope in the mooring to prevent megafauna entanglement



INSTALLING MOORING BUOYS FOR LARGE BOATS (large day boats approximately 43 foot/13m)

MATERIALS (for a mooring in 98 foot / 30m of water)

- 4x concrete blocks (1,000kg per block)
- 40m of 20mm galvanised chain
- 40m of 28mm polypropylene monofilament rope
- 6x shackles
- 1x orange surface buoy (18 inches in diameter)
- 1x underwater buoy, bottle or float to raise the chains (for example, 2 x 5 litre bottles would be sufficient)

STAFF

- 2x divers
- 6x boat crew

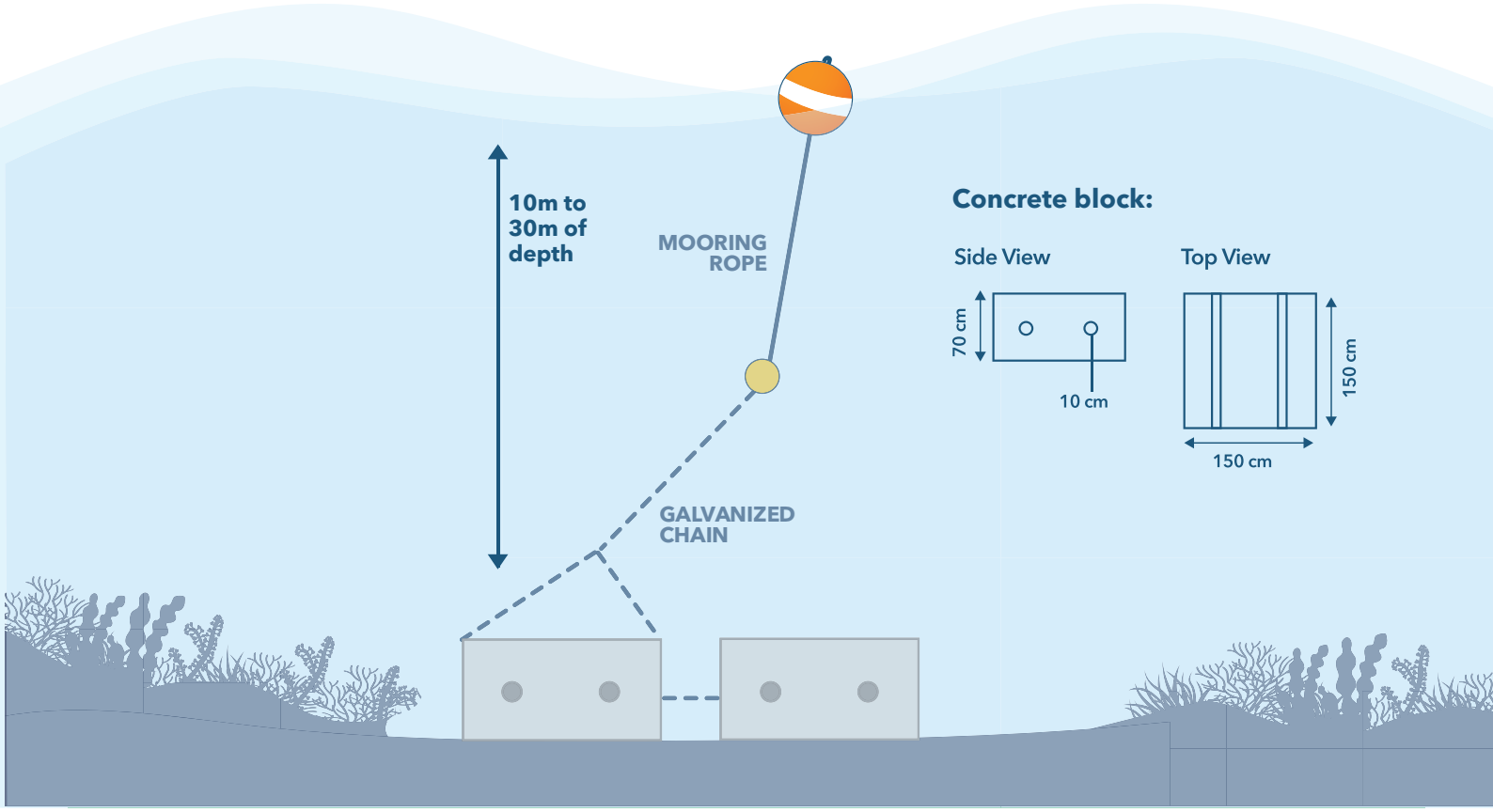
TIME

3 days total:

- Day 1: make the concrete blocks (ideally, close to shore)
- Day 2: Move the blocks to the mooring location
- Day 3: Dive to fix the chain to the blocks and fix the rope

CONCRETE BLOCK SPECIFICATIONS

- Try to choose an area where impact is minimal at all times.
- To place the concrete blocks, make sure you choose a sandy bottom or area where there are no delicate marine habitats (i.e. avoiding areas of seagrass or coral reef)
- Keep in mind when choosing the mooring location that storms can cause the blocks to be dragged across the seafloor and onto nearby reefs.
  - To minimise this, ensure the weight of the anchoring blocks is appropriate to the boat size
- Use a combination of four cement blocks: each one attached to the others by a galvanised chain. Alternatively, connect all concrete blocks up to one point with a single line going up to the surface to distribute the force being pulled on the blocks
  - The blocks need to be sunk in pairs connected by a chain
  - The blocks need to be reinforced (for example, by mixing the cement with scrap metal)
- We recommend installing mooring lines at depths of 10m to 30m as this makes it easier to monitor the condition of the chain and rope



Remember: as boat types differ, the specifications for building the mooring line will change too. Be sure to tailor this guide to ensure it's suitable for your own boat.

Make sure there are no excess loops or lengths of rope in the mooring to prevent megafauna entanglement

Tip: use large hose pipe cut to size to slip over the chain. This will prevent the chain from cutting into the cement blocks. Plastic piping can also be used to create holes through the concrete blocks which the chain or rope can be passed through.

MAINTAINING MOORING BUOYS

Once you've installed your mooring buoy, it's important to check it regularly and maintain it to prevent damage or wear-and-tear. Be sure to include routine checks and maintenance in your operational planning as you would with the upkeep of other equipment. When inspecting the mooring buoys, ensure you check:

- The condition of the lines and ropes
    - They may need cleaning or replacing
- The condition of the buoy/floats
    - Are there any cracks or damage that means it needs to be replaced?
    - Clean the buoy as required
- Check the cement blocks or rocks holding the mooring line are still secure
    - Look out for any signs of dragging or movement

Tip: Once you've checked over your mooring, be sure to add a calendar reminder for your next maintenance session!

ANCHOR USE FOR LIVEABOARDS

The reality is not all dive sites use mooring lines. Sometimes, anchoring can be the only option. This is particularly true for liveaboards, which travel far and wide to some of the world's most remote locations. If there is no alternative to anchoring, please ensure you drop anchor in a way that minimises the potential damage to coral reefs and marine life. Try and establish what the seafloor is composed of. Ideally, you want to choose a sandy bottom area that has less marine life than high biodiversity ecosystems such as seagrass or coral reefs (damage to fragile ecosystems like these can take many hundreds of years to repair).

Ensure your team minimises the environmental risk of anchoring (through direct reef contact or dragging) by following these steps:

1. Plan for anchorage
    a. Slow down: ensure the vessel is travelling at an appropriate speed
    b. Determine the direction and strength of the wind and current
    c. Establish the direction and flow of the tidal stream
    d. Select an appropriate anchor location. The anchor should only be dropped on a sandy bottom to prevent coral damage (except in the case of an emergency anchorage)

2. Brief the anchor team on:
    a. The anchor position on the vessel
    b. Anticipated scope
    c. Anticipated final manoeuvre prior to letting go or walking back
    d. Method for letting go or walking back
    e. Communications plan for the crew
    f. Escape / abort route should circumstances dictate
3. Prepare equipment
    a. Anchor(s), lights/shapes, anchor marking buoy etc.
    b. Remove the safety clip from the anchor and clip it onto its own base
    c. Turn on the windlass (anchor winch)
    d. Test that the anchor will go out freely by operating the winch down a bit. Free up the anchor if required
4. Forecastle: final check and visual inspection before the procedure begins
    a. Check the brakes are on and clear the voyage securing devices for the anchor
    b. Confirm power to the windlass
    c. Check the anchor shape and light
    d. Check the general appearance of visible components such as "D" shackle, crown shackle, swivel, kenter link and short chain
    e. Ensure "D" and crown shackle pins are in place and tightly secured
    f. Check the communications / signal bridge deck is ready for anchoring
5. Position the vessel forward of where you wish to anchor
6. Note your depth and location
7. Manoeuvre the vessel so the bow is pointing into the wind, current or opposite drift
8. Use a landmark or compass bearing to note the direction you are pointing
9. Upon release of the anchor, slowly reverse the vessel straight backwards
10. Ensure the engine remains on but out of gear until the anchor has made contact and has a firm hold of the substrate. back down on the anchor to make sure it's set and the boat isn't moving. Wait while using the GPS or nearby landmarks to see if the boat is drifting. If you are secure and the boat is not drifting, turn off the engine.
    a. Once the anchor is set, it's important to confirm the boat is hanging in a direction that keeps the rode/chain away from the reef. If wind and current conflict, the boat may be hanging in an unanticipated direction, which could cause damage to the reef.
    b. If the vessel is still dragging the anchor and is not holding, or if the boat is not hanging in a direction that keeps it away from the reef, you will need to lift up the anchor and try again.
11. Once you've confirmed the location is an appropriate site for future anchoring, record your location on GPS to allow you to return in future.
12. Prepare instructions to watch the anchor in case of drifting
    a. Set the GPS to alert on drift (for multiple GPS units)
    b. Undertake regular visual checks of the anchor position from the forecastle
    c. Ensure the crew is prepared to raise the anchor immediately should drifting occur
    d. Plan to restart the engine in case of drag
    e. Plan when engines should be started if the weather deteriorates

Even if you follow all these steps, the weather can be your enemy and can cause huge challenges. Always be aware of sudden changes to the weather conditions and ensure your team is prepared for a possible emergency.

OTHER CONSIDERATIONS

- **Anchoring is illegal in some locations.** Always investigate local laws and ensure you are following relevant regulations in your area.

- Often, there can be a **lack of compliance or enforcement when it comes to anchoring laws.** Remember, divers are in the water every day and can help build a case for installing buoys in the area by reporting any violations.

- If you're planning on installing mooring buoys, or any structures in coastal waters, **make sure you've checked with your local government unit (LGU) or relevant coastal management body for approval.**

- **Installing and maintaining mooring buoys can feel like a big task**, particularly for smaller operators. **Working together as a community is a great way to overcome this challenge**: find out if there are any local mooring programmes that you can join or if any other operators would be interested in collaborating with you on a mooring buoy programme.

- **Remember to involve your dive instructors and guides too:** ask them to visually check the rope/chain isn't on the reef at the beginning of a dive. If they notice any problems with the mooring lines, they can adjust it manually or flag to the team that it needs fixing before leaving the site

- **Lastly, remember that, from an environmental point of view, anchoring is a choice and can be avoided by using mooring buoys, drifting the vessel or other means of avoiding negative impact on the marine environment.** Only anchor at a certain location if you feel it is absolutely necessary. This does not include emergency situations.

CREDITS

Much of the information included in this document was originally sourced as part of the International Year of the Reef 2018 campaign (https://www.iyor2018.org/) with additional thanks to Explorer Ventures Liveaboard Diving Fleet (www.explorerventures.com), Six Senses Laamu (https://www.sixsenses.com/en/resorts/laamu) and AB Wonderdive – Bali Resort.

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The Reef-World Foundation leads the global implementation of the UN Environment Programme's Green Fins initiative, which focuses on driving environmentally friendly scuba diving and snorkelling practices across the industry globally

Please visit **www.reef-world.org** and **www.greenfins.net** or follow us on social media: **@GreenFins** **@Green_Fins**

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