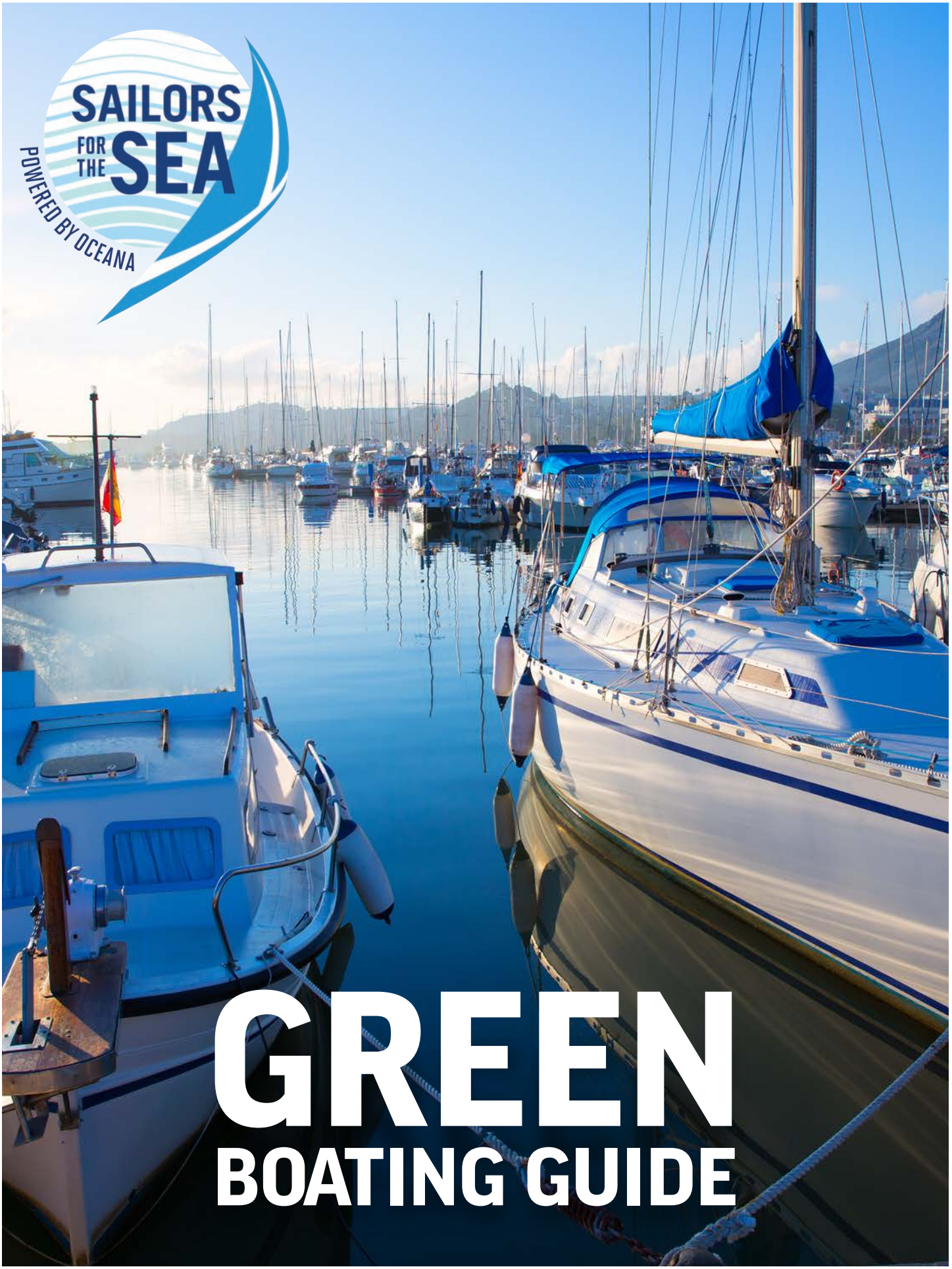
SAILORS FOR THE SEA

POWERED BY OCEANA



GREEN BOATING GUIDE

THE GO-TO GUIDE FOR ECO-SMART BOATING

GO GREEN FOR THE BIG BLUE

"I've sailed around the world now three times and I can see how much more debris there is in the water."

– Ian Walker, Winning Skipper of the 2014-2015 Volvo Ocean Race

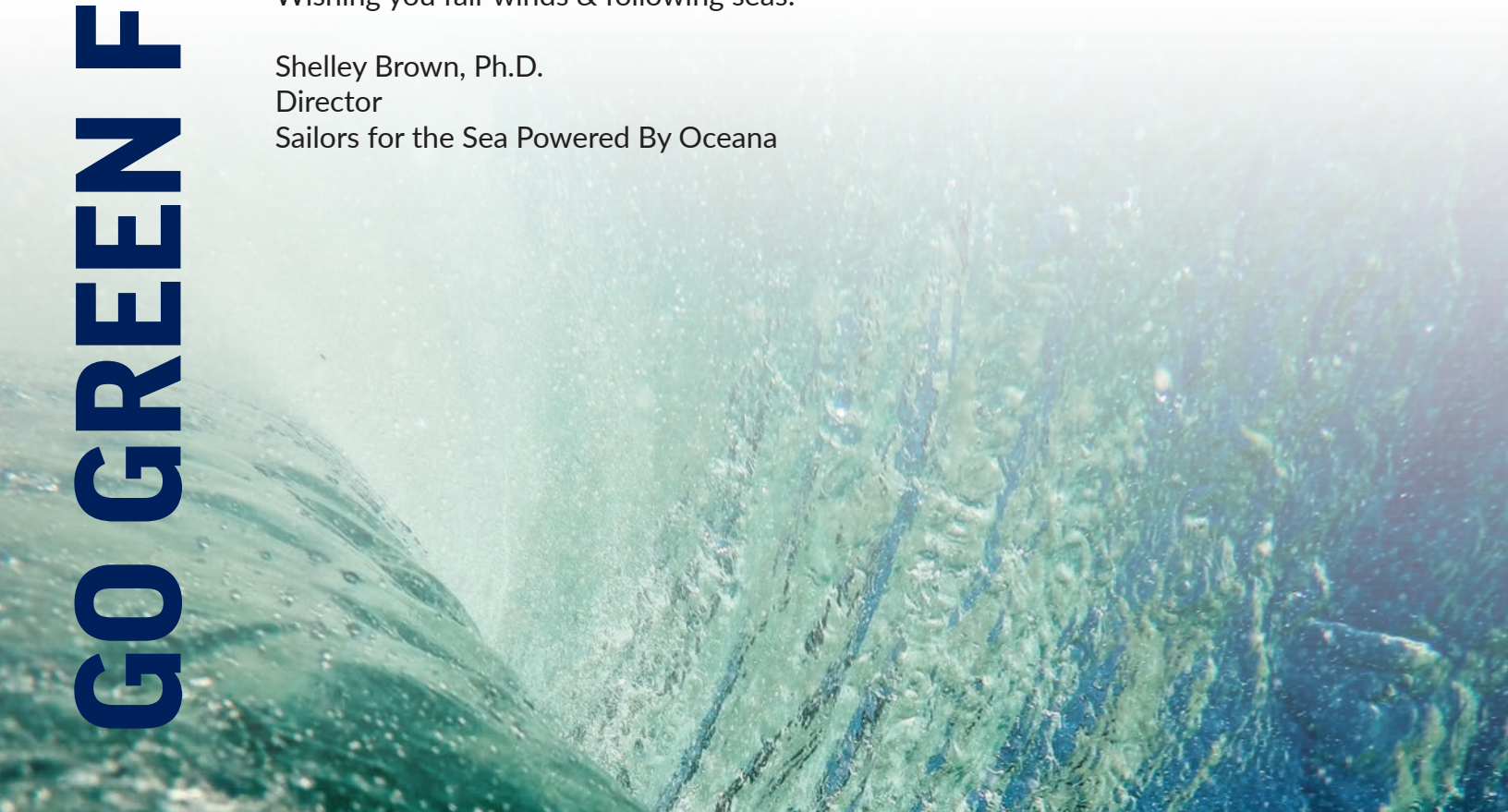
As boaters, we are intimately connected to our waterways. We have witnessed their beauty, their tranquility and power, and even their degradation. Our oceans, coastal waters, estuaries, rivers and lakes provide us with joy, adventure and solace. One of the best ways to preserve our local waters is by proactively managing and maintaining our vessels.

The Green Boating Guide is designed to provide information, tips and product suggestions to prevent pollution and reduce our impact on the environment. Every day, we can make choices to boat in a sustainable and environmentally friendly manner to help protect our precious waterways for our children and their children.

When we set out to create this guide, our goal at Sailors for the Sea was to make something pragmatic and useful. We view this guide as a working document if you have questions, comments or suggestions please send them to greenboating@sailorsforthesea.org.

Wishing you fair winds & following seas!

Shelley Brown, Ph.D.
Director
Sailors for the Sea Powered By Oceana



ACKNOWLEDGEMENTS

SAILORS FOR THE SEA POWERED BY OCEANA

Sailors for the Sea Powered by Oceana unites boaters to protect the ocean. Boaters see firsthand many issues that our oceans face, from pollution which fouls their playground, to overfishing and habitat destruction, which threaten marine life and the source of food for billions of people around the world.

Through our solution-oriented porgrams, we unite a core constituency of sailors and boaters, nearly 12 million strong, whose support helps to win victories to save the world's oceans.

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IN MEMORY OF DR. EDMUND "NED" CABOT

As a founding board member, Ned's passion for the ocean, sailing and education helped establish Sailors for the Sea. He was a skilled surgeon and teacher who had a love for the outdoors and was deeply devoted to the conservation of our natural world. He had a passion for adventure and a depth of understanding and knowledge, which he enjoyed sharing with others. Favoring the cold waters of the North Atlantic, Ned was an experienced, adventurous and supremely competent sailor. When you joined Ned for a cruise your first assignment was to read the boat's handbook, an organized guide covering a number of topics including safety, maintenance and sail care. Sailors for the Sea hopes to extend his legacy by educating boaters on the importance of protecting and preserving our precious waters.

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TOP TEN CHECKLIST

☐ FILL'ER UP CAREFULLY

Proper fueling procedures can help prevent fuel and oil from sneaking into our waterways. Try using an absorbent bib or collar to catch drips, and fill your tank slowly to prevent any overflow.

☐ BE PREPARED FOR A SPILL

Store spare oil-absorbent socks, pads and pillows onboard your boat, just in case a spill occurs. Since each spill will be handled differently, be sure to contact the marina and/or the U.S. Coast Guard National Response Center at 1-800-424-8802 for cleanup advice.

☐ LOWER YOUR CARBON FOOTPRINT

Reducing your fuel usage not only lowers your carbon footprint, but also saves you money. By decreasing extra weight onboard, keeping your hull clean and performing routine maintenance on your engine, you will make fewer trips to the fuel dock too!

☐ USE YOUR HEAD

If possible, use a Marine Sanitation Device with a holding tank to store sewage until it can be transferred ashore at a pumpout facility. If you're in an area without pumpout facilities, be sure you are more than three miles offshore before you discharge your blackwater – it's the law in the U.S.

☐ COME CLEAN

Research your cleaning products. Manufacturers are not required to disclose all of the ingredients on their containers, and due to lack of marketing regulation, any product can be labeled with words like natural, non-toxic, organic or biodegradable.

☐ PROTECT YOUR BOTTOM

Copper is the most commonly used biocide, but it has been shown to be toxic to marine plants and animals. Try alternative antifouling paints or coatings – they are less toxic and can save you money, since they generally last longer on your hull than copper-based paint.

☐ GET TO KNOW YOUR WILDLIFE

Before you go out boating, research animals that may be in the region – knowing what species to look for can help avoid collisions. When viewing wildlife, remain at least 300 feet away and limit your viewing time to 30 minutes.

☐ STOP AN INVASION

By properly cleaning your boat and equipment after each use, you can help prevent the spread of non-native plants and animals. Removing all vegetation and spraying your boat, trailer and equipment with high-pressure water and rinsing with hot water will help stop invasive hitchhikers.

☐ DO MOOR

When choosing where to settle in for the night, first look for available mooring buoys. If you decide to anchor, check your charts and review advice from fellow mariners to avoid sensitive habitats including seagrass beds and coral reefs. Anchors and anchor chains can cause significant damage to these habitats.

☐ REDUCE, REUSE, RECYCLE

Limit the amount of single-plastic you use and opt for reusable items, including water bottles, plates and flatware. Boat materials, such as shrinkwrap, oil, antifreeze, fishing line and batteries can be recycled, in addition to bottles, cans and paper.

SPILLPROOF FUELING

Filling up our tanks is the most common way that we unintentionally pollute our waters – even a tiny spill is toxic to our waterways, harming both animals and plants. The cost to prevent a fuel spill is significantly less than the cost to clean it up; so a little planning goes a long way toward keeping our environment clean.

For proper fueling procedures, follow these steps:

Before:

- Check fuel lines and tanks for any cracks, signs of corrosion or damage, and leaks.
- Have absorbent bib, collar and a spill kit on hand to catch any potential drips or spills.
- Know the capacity of your fuel tanks or portable container.
- Consider installing an overflow attachment for the fuel tank air vent, which acts as a fuel/air separator that releases air and vapor while containing any overflow.

During:

- Place an absorbent bib around the fuel intake or a collar around the fuel nozzle to catch drips and any overflow.
- Position yourself so you can see the deck fill and comfortably hold the nozzle in contact with the edge of the fill.
- Fill the tank slowly and listen for a change in tone, as it gets full. The U.S. Coast Guard recommends filling inboard tanks to 90% capacity to allow for expansion due to heat. Boat fuel tanks are not pressurized like car fuel tanks, so the pump automatic shut-off nozzle rarely works.

After:

- Wipe up any accidental spills and dispose of rags/absorbent fuel bib/collar as hazardous waste.

Portable fuel cans

The transportation and transfer of fuel with portable fuel cans (aka jerrycans) often leads to accidental fuel spills. All new jerrycans sold in the U.S. must meet a set of regulations to prevent spills and decrease fuel vapors being released into the atmosphere. Always fill jerrycans ashore on a level surface, where spills are less likely to occur and easier to clean up. The new jerrycans will fill more slowly; however, the lack of vapors escaping and minimized fuel spills makes the portable can a better product for the environment.

With care, recreational boaters can take steps to mitigate the risk of accidentally spilling oil or fuel while operating their vessel.

Did you know?

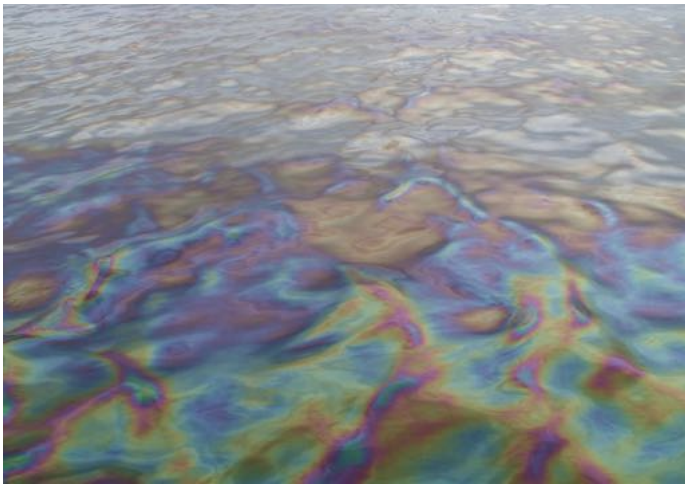
- Land-based runoff and recreational boats account for 64% of the petroleum that enters North American marine waters each year (National Academy of Sciences).
- An estimated 70,262 gallons of fuel is spilled by the use of jerrycans each year (U.S. Environmental Protection Agency, EPA).

OIL & FUEL SPILLS

What steps should you take if you spill oil or fuel into the water?

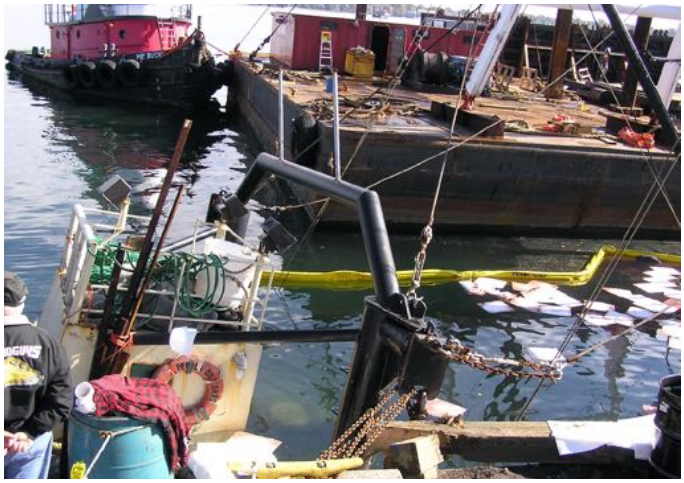
1. First identify the cause and source of the spill and if possible, stop the source immediately.
2. Notify the marina or fuel dock (if applicable), as they should have oil absorbent pads and booms to contain the spill. Dispose of used absorbent materials as hazardous waste.
3. Anytime a spill produces a sheen on the water, the U.S. Coast Guard National Response Center at **1-800-424-8802** must be notified. You may need to provide:
    - Location of the incident
    - Cause or source of spill
    - Type and amount of fuel spilled
    - Level of danger or threat
    - Weather conditions at location
4. Absorbent socks, pads and pillows can be used in open-water spills to minimize damage while awaiting professional response after reporting the spill. Each spill will be handled differently, so it is best to get advice from the marina and/or the U.S. Coast Guard.
5. Never use detergent or dish soap to make the spill disappear. Using dish soap dispersant does not get rid of the spill; it simply breaks it down into smaller droplets, making the spill harder to clean and more toxic to marine life.

An absorbent boom put in place to protect sensitive areas from oil discharge. Photo credit: USCG



With care, recreational boaters can take steps to mitigate the risk of accidentally spilling oil or fuel while operating their vessel. To prevent spills or accidental discharge, check out:

- Spillproof Fueling
- Bilge Maintenance



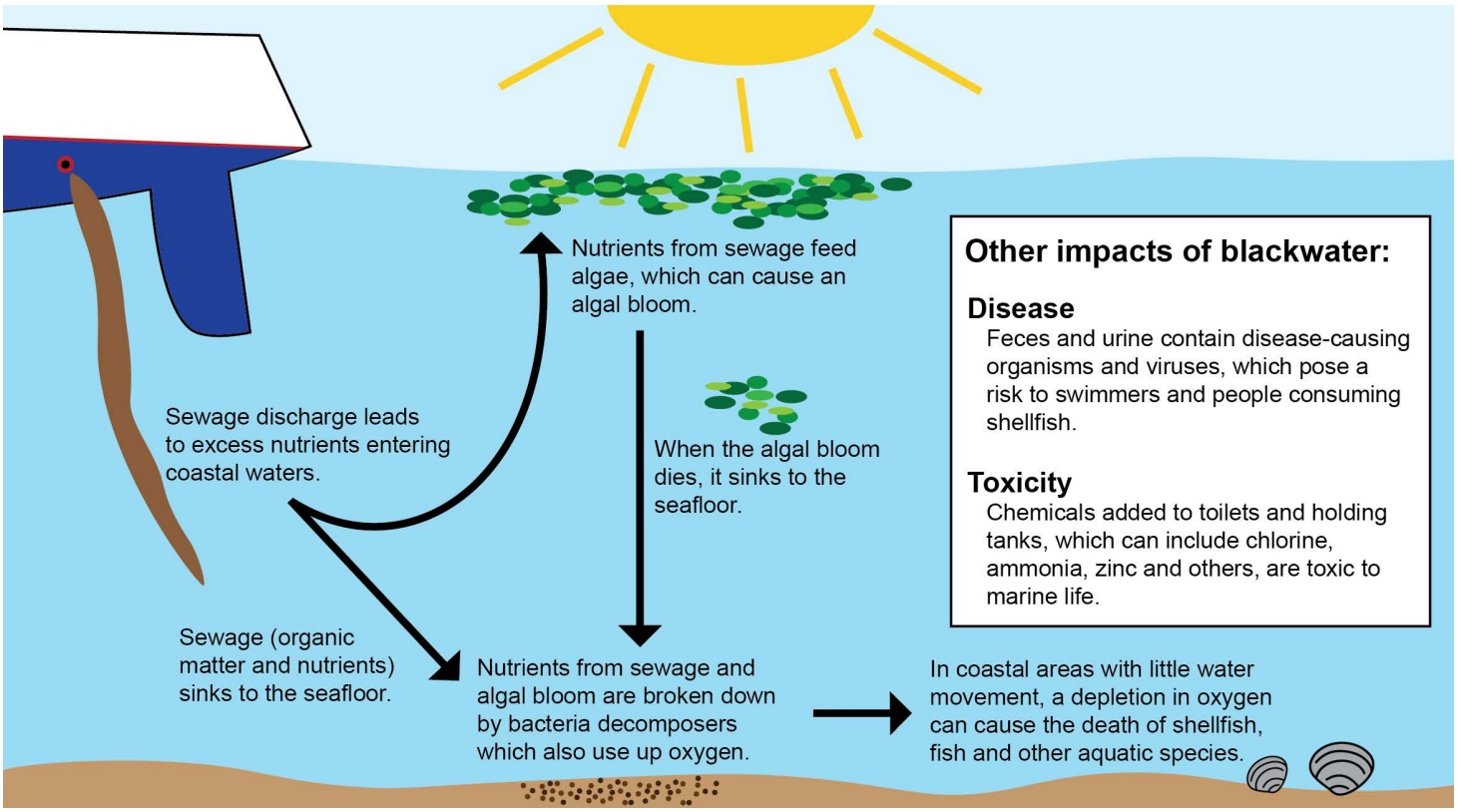
An abosorbent boom and fuel pads placed in water to collect oil released from a sunken boat. Photo credit: Massachusetts DEP.

Did you know?

- One pint (2 cups) of oil released into the water can spread into a one-acre oil slick, larger than a U.S. football field (U.S. EPA).

What is blackwater and how does it affect aquatic environments?

Sewage discharge (also known as blackwater) contains pollutants including nutrients, metals, toxins and pathogens. Blackwater discharged from your boat can impair water quality, negatively affect aquatic ecosystems and increase risks to human health.



The law

Under federal law, it's illegal to dump raw, untreated sewage into navigable U.S. waters, including coastal waters within 3 miles of shore and inland waters (lakes, reservoirs, rivers, etc.). A No Discharge Zone (NDZ) takes this law a step further and prohibits the discharge of both treated and untreated sewage overboard from marine heads or holding tanks into a designated body of water.

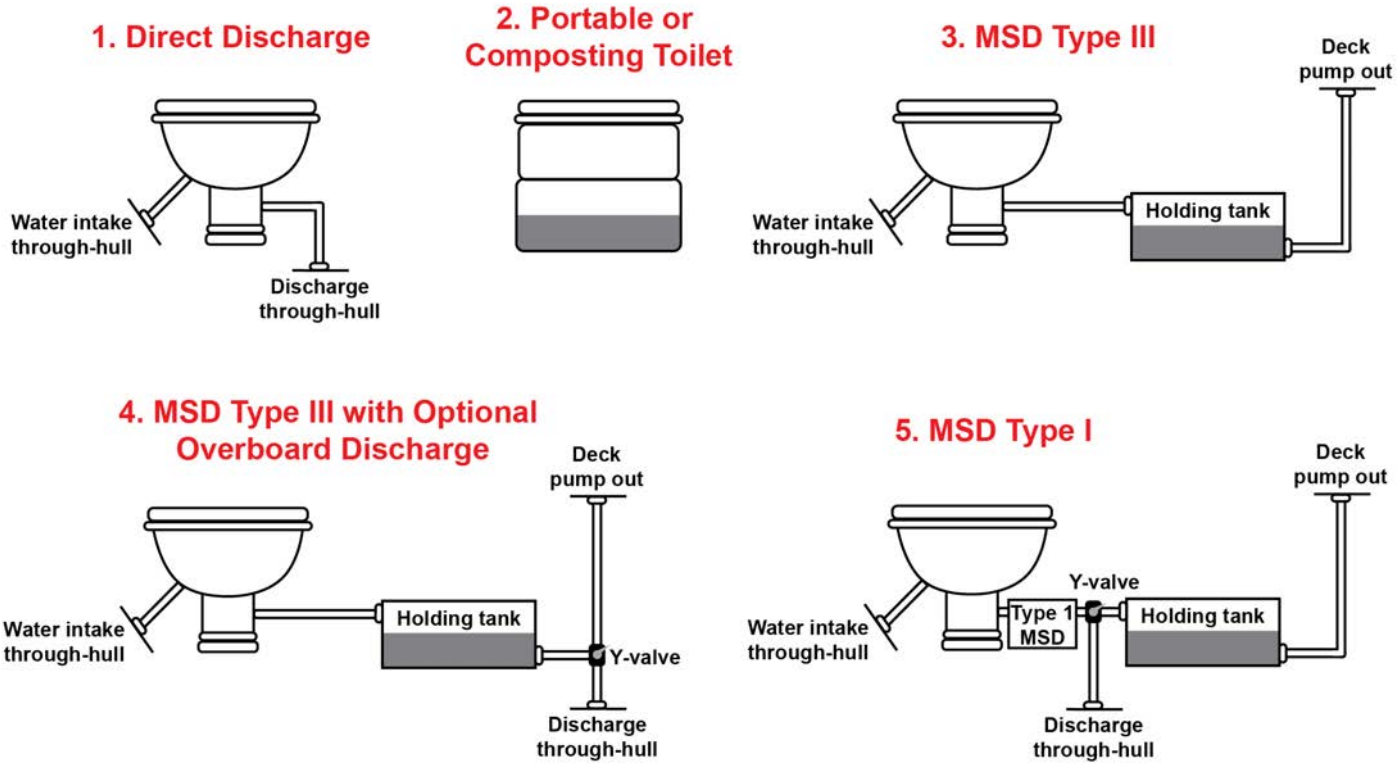
A NDZ is created if a state determines that a body of water either:

- Requires greater environmental protection and there are adequate pumpout facilities available
- Has particular environmental importance (e.g. sensitive areas such as shellfish beds or coral reefs)
- Or has drinking water intake zones

It's important to know the locations of any No Discharge Zones and pumpout stations in the areas where you are boating. The U.S. EPA provides a list of NDZs and pumpout facilities by state.

All boats in U.S. waters with permanently installed toilets are required by federal law to have a Marine Sanitation Device (MSD) onboard that either stores sewage until it can be transferred ashore, or treats sewage to reduce the coliform count to such low levels that discharged blackwater poses no public health hazard.

What are your options for dealing with blackwater?



There are several ways to handle blackwater onboard your boat, including the following:

1. **Direct Discharge:** If you are boating in foreign countries (e.g. Caribbean) that do not have waste pumpout facilities, try to discharge your waste overboard while underway in deep water away from beaches and anchorage sites. Pumping out your waste near shore is harmful to swimmers, snorkelers, divers, other recreational users, and those who eat the local fish and shellfish.
2. **Portable or Composting Toilet:** They don't require installed water, power or holding tank, and are great for weekend trips. Check out Nature's Head and Air Head Dry Toilet for composting options.
3. **MSD Type III:** For regions with adequate pumpout facilities, a holding tank connected between your head's discharge and a through-deck pumpout fitting is simple, inexpensive to install and meets the requirements of the law. It is the most common type of MSD for recreational boaters.
4. **MSD Type III with Optional Overboard Discharge:** In addition to the deck pumpout fitting, a Y-valve can be placed after the holding tank, so sewage can be directly dumped overboard beyond the three-mile limit. Y-valve must be secured to prevent accidental discharge of untreated sewage.
5. **MSD Type I:** All of the waste is treated by maceration or chlorination before entering the holding tank or being directly dumped overboard. Offshore recreations boats generally use this type of MSD.

*There is a MSD Type II, which treats sewage through aerobic digestion. However, it is generally found on large commercial vessels.

Did you know?

- Discharge from a single boat over one weekend contributes the same amount of bacterial pollution as the treated sewage from 10,000 people (California State Water Resources Control Board)!

GRAYWATER

What is graywater?

Graywater is the untreated water from your onboard sinks, showers, washing machine, dishwasher and the wastewater from cleaning your boat with detergents, soaps and bleaches.

It's a major polluter of the marine environment, especially in ports and coastal areas. In some states, graywater is considered sewage and regulated as such, making soap bubbles on the water's surface a reportable pollution offense. Many marinas and harbors now have a no-discharge policy.

How does graywater affect aquatic environments?

Similarly to blackwater (sewage discharge), when graywater enters the aquatic environment, the associated chemical nutrients decompose in the water leading to less available oxygen for aquatic life.

This influx of nutrients also promotes rapid algal growth, a process called eutrophication. Overrun by algae, ecosystems are eventually depleted of oxygen, causing fish, shellfish and other aquatic life to suffocate, resulting in dead zones.

How can you reduce the impact of graywater?

- Research cleaners before you buy them. (See Non-toxic Cleaning Products for tips and suggestions).
- Use water saving devices such as low-flow showerheads and on-demand sink nozzles.
- Use sink strainers to catch food waste and solid particles, and dispose of them in the garbage.
- Whenever possible, use shoreside facilities for showering, laundry, dishwashing, etc.
- When at sea, retain your graywater for a pumpout facility. If this is not possible, treat graywater as if it were sewage, and only discharge if you're at least 3 miles offshore.
- Try water-only wash downs. Often times they can do trick when cleaning your boat regularly.

Did you know?

- Some marinas have pumpout facilities specifically designed for graywater. Ask your marina manager.

WASTE REDUCTION

Plastic pollution is one of the largest threats facing our oceans. Plastics are used in an enormous and expanding range of products due to their relatively low cost, ease of manufacture and versatility. Most are petroleum-based plastic, a product designed to last forever. They pose an ever-increasing problem to aquatic environments, as they don't biodegrade. Plastics breakdown into smaller and smaller pieces, but don't get absorbed into our natural systems and therefore never disappear.

Photo credit: Gavin Parsons/Marine Photobank

What are the impacts of marine debris?

Marine debris not only damages important habitats including coral reefs, shellfish and seagrass beds, but also causes significant harm to wildlife, including sea turtles, whales and birds. And plastics are not only toxic themselves, but they act as sponges absorbing toxins and chemicals in the water. When marine creatures consume the small plastic debris and plastic bags that resemble their food sources, the plastics and toxins enter the food chain and may eventually end up on our dinner plates.

Marine debris can also be quite large and difficult to see in the ocean, especially if it's floating just below the surface. Accidentally striking debris can severely damage or sink your vessel.

As boaters, there are many ways we can keep our oceans clean and prevent debris from entering our waterways.

Before you leave the dock:

- Buy products in bulk to reduce the amount of packaging you need to discard.
- Remove packaging from products before you carry them onto your boat.
- Use bamboo utensils, silicone storage bags, glass jars, canvas bags and other reusables to replace disposable items.
- Install a water filtration system onboard to use with mineral tablets instead of buying plastic water bottles.

Onboard:

- Don't throw any trash overboard.
- Secure possessions below deck before the seas get rough, so nothing is accidentally lost overboard. If gear is lost, try to recover it by making it a man-overboard drill.
- Think of creative ways to upcycle and reuse throwaway items.
- Practice Plus One Boating by bringing back whatever you take out, plus one trash item you find.

Back on land:

- Take all trash ashore and dispose of it appropriately, either by recycling what you can (paper, plastic, glass, cans, plastics, antifreeze, oil, lead batteries, fishing gear and fishing line) by placing it in the correct marina dumpster or as part of your home waste system.
- Encourage marinas to offer recycling facilities if they don't already.

Learn how you can get involved to fight the plastic pollution crisis.

Did you know?

- An average of 17.6 billion pounds of plastic waste enters the ocean from land every year (J Jambeck, Science).
- 693 different species have encountered marine debris, many suffering from ingestion and entanglement (Plymouth University).

REPURPOSE GEAR

Whether you are a competitive racer or enjoy boating recreationally, there are a lot of different types of gear that you will use while boating, including life jackets, wetsuits, foul weather gear, gloves and ropes.

What do you do with gear that has been outgrown or has reached its end life? There are a variety of ways to reuse, repurpose and recycle boating gear to help reduce waste that may otherwise end up in the landfill or our oceans.

Personal clothing and gear:

- Support companies that will help maintain or repair clothing and gear to prolong the life your items.
- At your marina or club, set up a gear donation box where boaters can donate clothing, gloves and life jackets that they are no longer using.
- Set up a gear swap day to trade useful items with other boaters.
- Send your old wetsuits to be recycled into neoprene yoga mats.

Sails:

- Send your used sails to a company that will transform the material into reusable bags.
- Research other opportunities to repurpose retired sails. For example, the Royal Canadian Yacht Club collaborates with Canadian Food for Children to send used sails to third world countries for ground and roof covers.
- Set up a sail drive at your club or marina to collect old sails.

Ropes and lines:

- Upcycle your old line into a rope rug, durable dog leash or even a rope koozie.
- Research companies that will collect your used rope and repurpose into other items.

Did you know?

- Personal flotation devices (PFDs) do not have expiration dates. However, if you are donating gear that is used for safety, ensure that fabric is free of rips and the flotation material has not deteriorated. Regular wear and tear and poor storage can impact how a life jacket performs and protects the user when they're in the water.

NON-TOXIC CLEANING PRODUCTS

Many cleaning products are harmful to aquatic life, water quality and the overall ecosystem. Some chemicals damage fish tissues, while others create nutrient imbalances leading to algal blooms. Whether you clean your boat on land or in the water, the choice of product that you use is important.

Tips for cleaning:

- Regularly rinse your boat with freshwater to reduce the need for harsh chemicals.
- Research your cleaners. Manufacturers of chemical products are not required to list ingredients on containers or make them public.
- Use cleaning products sparingly and try to prevent graywater from directly draining into your waterways. Try utilizing designated washdown areas at your marina, or wash items on a grassy area, which can help absorb runoff.

Which products to buy?

BoatU.S. Foundation recently updated their 2009 study and tested 9 new "green" boat soaps to see if the products lived up to their environmental claims while still cleaning a vessel effectively. Interestingly, they found that the "greenness" of a cleaner did not impact its ability to clean.

Based on their research and weighing all the factors (cleaning, performance, toxicity and biodegradability), here are some of the top product recommendations:

1. 303 Multi-Surface Cleaner

2. Boat Zoap

3. MaryKate Super Suds Boat Soap

Additionally, Ecoworks Marine has a variety of products to clean every part of your boat. All of their products are compliant and surpass the MARPOL Annex 5 1.7.5 criteria and declared not harmful to the marine or river environment.

Make your own homemade cleaners

With the following seven products that you may already have in your kitchen cabinets, you can clean most of your boat and boating accessories in an eco-smart and cost-effective way.

White vinegar
- acidic
- dissloves dirt and debris
- antibacterial

Baking soda
- mildly alkaline
- slightly abrasive
- dissolves dirt and grease

Borax
- alkaline
- dissolves stains, mold and mildew

Hydrogen peroxide
- disinfectant that is anti-bacterial and viral

Lemon juice
- acidic
- dissloves dirt and debris
- antibacterial

Cream of Tartar
- mildly acidic
- slightly abrasive
- dissolves dirt and grease

Salt
- gently scours
- boosts cleaning and deodorizing action of mixture

Recipes for cleaning your boat and gear

All-purpose
- White vinegar
- Water
- Bucket
- Brush or cloth

This simple mixture can be used for general cleaning purposes on your boat. In a bucket, add 1 cup of vinegar to a gallon of water. Use a brush or cloth to clean surfaces of dirt. Rinse with water.

Mildew remover
- Lemon juice
- Salt
- Bowl and spoon
- Brush or cloth

For mildew stains on canvas or cloth surfaces, mix one part lemon juice and one part salt in a bowl. Apply the mixture to the mildew stain and scrub. Rinse with water and let items dry fully in the sun.

Stainless steel
- Baking soda
- Water
- White vinegar
- Bowl and spoon
- Cloth

In a bowl, add baking soda and water. Mix until you make a thick paste. Rub the paste on the surface with cloth. Rinse with water. To remove water spots, wipe area with cloth that has been dipped in vinegar.

Life jackets
- White vinegar
- Water
- Hydrogen peroxide
- Bucket

In a bucket, add 1 cup of white vinegar to a gallon of water. Soak for 30 mins and rinse with water. To sanitize, add 1 cup of hydrogen peroxide to a gallon of water in a bucket. Repeat process and then dry.

Aluminum
- Cream of tartar
- Water
- Bucket
- Tablespoon
- Cloth

In a small bucket, add 2 tablespoons of cream of tartar to 1 quart of hot water, and mix. Use a cloth dipped in the mixture to clean aluminum. Rinse with water. Cream of tartar is used instead of baking soda because it can cause the metal to oxidize.

Sails
- Borax
- Water
- Bucket
- Sponge
- Soft brush

Add 1 to 2 cups of borax to a gallon of hot water. Use sponge to apply mixture to a damp sail. Use a soft scrub brush for stains. Let the mixture soak on for 2 hours. Rinse with water. Dry the sail fully by hoisting it or drape the sail in a dry place in the sun.

Which eco-friendly cleaners are best for below deck?

You can use the same environmentally friendly products that you use in your household. Here are some companies that produce eco-friendly cleaning products:

- BioKleen
- Bon Ami
- Ecover
- PureGreen24
- Seventh Generation
- Simple Green

To ensure that your cleaner is safe and eco-friendly, look to see if your cleaner is a part of these programs:

- The Environment Protection Agency's Design for Environment (DfE) created the Safer Choice label, which means every ingredient in the product has been evaluated to ensure it meets the EPA's stringent criteria. Additionally, the EPA creates partnerships with manufacturers to create products, whose ingredients are less toxic, less persistent (i.e., they biodegrade faster), less bioaccumulative (i.e., they do not build up in living tissue of humans or animals) and whose ingredient byproducts have similar characteristics.

SAFER CHOICE
Meets U.S. EPA Safer Product Standards
epa.gov/saferchoice

- The Environmental Working Group (EWG) is a nonprofit dedicated to protecting human health and the environment. EWG's staff scientists compare the product ingredients, websites and worker safety documents with the information available in government, industry and academic toxicity databases and the scientific literature on health and environmental problems tied to cleaning products. They use that information to create EWG's Guide to Healthy Cleaning, which provides you with easy-to-navigate safety ratings for a wide range of cleaners and ingredients.

Plan ahead:

Whether you are buying cleaning products or making your own from items in your kitchen, it's important to try to limit what ends up going into your waterways. Think ahead when planning your cleaning routine.

Try to keep wash liquids away from your waterways (See Graywater).

Also, use rags and old clothes to clean, rather than disposable items like paper towels.

Did you know?

- There is no regulation on the use of "natural", "non-toxic", "organic" or "biodegradable" for cleaners. These labels can be misleading, so make sure to research your cleaning products before you buy them.

BOTTOM PAINT

Everything below the waterline of your boat is part of the marine ecosystem. Left without any protection, your boat will start to attract multiple organisms, including algae, slime, seaweed, barnacles and mussels.

How do you prevent growth on your hull?

The most common method to prevent this growth (also known as biofouling) is the application of a bottom antifouling paint. There are three broad groups of hull paint:

- Ablative
- Hard
- Hybrid

Ablative paints gradually wear away, continually revealing fresh biocide (chemical to kill microorganisms) as your boat moves through the water. With hard bottom paints, the biocide slowly dissolves (rather than the paint itself), allowing water to penetrate deeper into the paint until all the biocide is depleted. Hybrid paints incorporate the benefits of both ablative and hard paints into a single product.

Today, the most commonly used biocide in antifouling paint is copper oxide. Copper is a naturally occurring element, but at high enough concentrations, it interferes with cell metabolism making it challenging for life to grow on your boat's hull. The problem with using copper in antifouling paint is that it also leaches into the marine environment and can accumulate in filter feeders such as clams and mussels, and damage the larval stages of aquatic invertebrates and some fish species. Marinas and protected anchorages with little current or tidal movement are particularly vulnerable, as they allow the buildup of copper to toxic levels.

What are the eco-frienldy options?

To replace copper-based paints, some manufacturers have turned to using zinc as a deterrent. However, a biocide is intended to kill what's growing on your hull, so replacing a biocide with another biocide doesn't solve the environmental problem. Nonbiocides are designed to create a slippery, slick surface (e.g. silicon, epoxy, ceramic) so that organisms can't attach to a boat's hull.

The U.S. EPA provided funding for a three-year project undertaken by the Port of San Diego called "Safer Alternatives to Copper Antifouling Paints for Marine Vessels". The project evaluated three factors (application, performance and cost) to determine whether alternative paints were comparable to copper hull paints in both warm- and cold-water regions. The results determined that some alternative antifouling paints are less toxic environmentally, and can save money because they last longer than copper paint.

Based on the study, the top performing alternative bottom paints were:

1. Hempasil X3 (87500) - Hempel USA

2. Intersleek Pro (replaced Intersleek 900) - Interlux

These two paints are nonbiocides, which are commonly formulated with silicon compounds creating a slippery surface. Hulls coated in nonbiocide paints can be cleaned relatively easy and some have much longer lifespans, ranging from 5 to more than 10 years.

What type of hull paint is best for your boat?

Selecting the best bottom antifouling paint for your boat is far from a simple decision. It's important to understand how alternative hull paints work, and the short- and long-term costs. Plus new types of eco-paints are being manufactured all the time.

Factors to consider:

- What type of boat you own, the frequency of use, and the average speed
- Cost and desired paint lifespan
- Existing hull coatings
- Realistic maintenance schedule

Tips for removing your old bottom paint:

- Scrub your hull on land during a haul-out period.
- Place a tarp or filter cloth under the boat to catch paint and scraping chips.
- It's dangerous to remove any large areas of antifouling by dry sanding, both to the operator and environment. If possible, place a tent over your boat to contain airborne particles or choose a still, windless day to sand. Try to wet sand or use a vacuum sander to remove old paint.
- When you have finished, collect any waste for safe disposal in a hazardous waste receptacle.

Tips for applying new bottom paint:

- Make sure that the hull is thoroughly cleaned and rinsed, and follow the manufacturer's instructions for paint application.
- Place a tarp or filter cloth under the hull to catch drips or spills.

Did you know?

- In San Diego Bay, 72% of the copper entering the water is due to discharges from antifouling paint and in-water hull cleaning (Office of Naval Research).

SUNSCREENS

Before you hit the high seas, you may be wondering what type of sunscreen to buy to protect your skin from the sun's powerful rays. Did you know that some SPF products are harmful not only for you, but also the environment? Some sunscreens contain chemical additives, such as oxybenzone, that can be toxic when they wash off in the ocean and have been reported to contribute to coral bleaching, damage coral larvae and disrupt the development of fish.

Sunscreens can protect you by a physical or chemical barrier. Zinc oxide and titanium dioxide are microparticles that form a physical barrier that scatters damaging UV rays away from your skin. Chemical sunscreens including ones that contain oxybenzone, absorb UV rays, preventing them from penetrating the skin.

Check the ingredients. You want to avoid products that contain oxybenzone, and look for ones that contain zinc oxide or titanium dioxide (micro, not nanoparticles), as these are less toxic to your health and the environment. The sunscreens on our list are eco-friendly, protect against UVA and UVB rays, and are all under $20. Our top choices are:

1. All Terrain – TerraSport SPF 30 $16.99 (3 fl oz)

2. Avasol – Surfer's Barrier Stick SPF 30 $19.95 (1 oz)

3. Badger Sunscreen Cream, Unscented SPF 30 $15.99 (2.9 fl oz)

4. Stream2Sea Sunscreen for Body SPF 30 $16.95 (3 fl oz)

5. Thinksport Safe Sunscreen SPF 50+ $12.99 (3 fl oz)

6. True Natural All Natural Sunscreen SPF 30 $18.99 (3.4 fl oz)

Did you know?

- Plant-based oils, like lavender, tea tree and eucalyptus, which are sometimes added to sunscress as natural insecticides, may kill delicate coral cells (Dr. Craig Downs, Haereticus Enviromental Laboratory).

CARBON FOOTPRINT

What's the Global Carbon Cycle?

Moderate levels of carbon dioxide (CO_2) in our atmosphere are normal, as CO_2 helps keep the planet warm and plays an integral role in many key biological processes, including photosynthesis. The earth naturally produces and processes CO_2 in what is referred to as the Global Carbon Cycle.

Human activities have altered this natural cycle by adding more CO_2 to the atmosphere, and by affecting the ability of natural sources to remove it. The primary cause of increased CO_2 concentrations in the atmosphere is due to the burning of fossil fuels (oil, coal and natural gas), as well as changes in land-use (deforestation).

The ocean plays a key role in keeping the carbon cycle in balance by absorbing excess CO_2 from the atmosphere. When CO_2 is absorbed by seawater, chemical reactions occur that increases the acidity of the water, a process known as ocean acidification. This increase in acidity will make it more difficult for corals to build or maintain skeletons, and for shellfish such as lobsters, scallops and clams to build shells.

Oceans also face elevated temperatures, rising sea levels and an increase in storms due to the warming of the atmosphere. Without conscious effort, CO_2 concentrations will continue to rise in the atmosphere and our ocean ecosystems will suffer. We can take personal action to decrease CO_2 emissions to protect our ocean.

What's a carbon footprint?

It's a measure of the impact our activities have on the environment. It calculates the greenhouse gases we have, or are expected to produce in our activities, and measures them in pounds or tons of CO_2. Personal carbon footprint emissions can come from direct sources such as driving your car or indirect sources such as the fuel burned to produce a product you've purchased.

We can effectively lower our carbon footprint by improving the energy efficiency in our homes, on our boats, and by purchasing local products and changing our consumption patterns.

What's your boat's carbon footprint?

Your boat's carbon footprint is the emission of CO_2 primarily from burning the fuel in your engine(s) and generator.

No two boats are the same and each will have a different footprint. The size and type of the engine(s), their age, the fuel type, your average cruising speed, the fuel efficiency and number of hours you use your boat all contribute.

As these factors are hard to quantify, the easiest route to estimating your boat's footprint is by keeping track of your fuel usage.

How do you calculate your boat's carbon footprint?

You can calculate your carbon footprint by determining the average number of gallons your engine(s) use per hour, then multiply this by the total number of hours you use your engine(s) during the season or year.

You will then multiply the result by the pounds of CO_2 for your fuel type:

One Gallon of Fuel	Pounds (lb) of CO_2 per Gallon
Marine Diesel	21.24
Marine Unleaded 93	19.88
Marine Unleaded 91	19.51
Marine Unleaded 89	19.52
Jet A	21.10
Biodiesel	5.02

For example:

During the past year, if you use 10 gallons of fuel per hour and you ran your engine for 204 total hours, your calculation would be:

10 gallons x 204 hours
= 2040 gallons

If your fuel type is marine diesel:

2040 gallons x 21.24 lb of CO_2/gallon
= 43,329 lb of CO_2, which is
equivalent to 21.7 U.S. tons

The key to lowering your boat's carbon footprint is to decrease your fuel consumption! You will also save money - win win for the environment and your wallet!

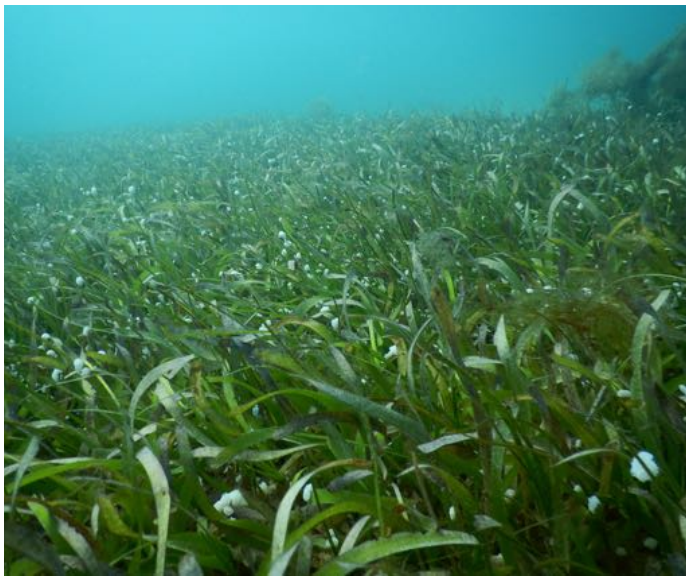
For tips on how, check out:

- Reducing Fuel Usage
- Renewable Energy

How do you offset your carbon footprint?

Purchasing carbon offsets is one of the ways you can help address the imbalance that our daily lives have on our environment. A carbon offset is a reduction in emission of CO_2 made in order to compensate for (or to offset) emissions made elsewhere.

The Ocean Foundation's Seagrass Grow offers the first carbon offset program where you can compensate for your impact with "blue carbon" through the planting of seagrass meadows.



Impressively, seagrass habitats are up to 35 times more effective than the most pristine Amazonian rainforest in their ability to absorb excess CO_2 and store it. Additionally, a single acre of seagrass may support as many as 40,000 fish, and 50 million small invertebrates (Seagrass Grow).

Better yet, Seagrass Grow focuses their replanting efforts on areas that have been damaged by boat propellers and anchors.

Did you know?

- Seagrasses only occupy 0.1% of the seafloor, yet are responsible for 11% of the organic carbon buried in the ocean.

REDUCE FUEL USAGE

How you take care of and drive your vessel has a large effect on how much fuel you use.

Before your trip:

1. Perform routine engine maintenance.
   - Change fuel filters regularly – they remove unwanted particles, increasing engine efficiency.
   - Fuel additives will clean engine parts, breaking down harmful substances.
2. Check your propeller (prop).
   - Choose the correct prop for your boat type.
   - Look for bent blades, dings or eroded edges, as damage will increase fuel usage.
3. Maintain the bottom of your vessel.
   - Regularly clean your hull as growth increases friction, slowing your boat down.
   - Antifouling hull paint can prevent growth. See Bottom Paint for eco-friendly options.
4. Install a fuel flow meter.
   - Measure fuel consumption at different revolutions per minute (rpm) to find the most efficient speed for your vessel.
   - Use these figures to monitor your boat's performance.
5. Plan ahead. Tides and winds are relevant to both sail and power boats. Cruising against the tide or into strong winds requires more engine power than moving with them.
6. Decrease extra weight onboard.
   - Empty your holding tank often.
   - Bring and/or store only the items you need onboard.

During your trip:

1. Operate your vessel at a fuel-effiecent engine RPM to reduce emissions and save money.
2. Using trim tabs and power trim carefully prevents plowing and reduces drag, allowing the boat to plane at a lower rpm.
3. Check your wake.
   - A large wake indicates that your boat is trying to climb the water's surface and is using extra power and fuel.
   - To remedy this, either slow down or quickly speed up to plane to create a smaller wake.

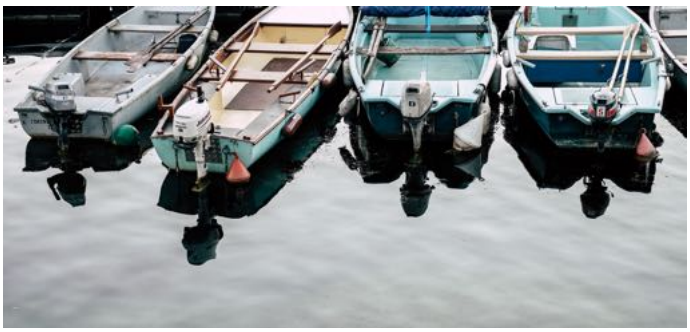
4. Read smoke signals. The color of your diesel engine's exhaust can indicate engine efficiency problems:
   - **Black smoke** – indicates unburned or partially burned fuel, meaning the engine is overloaded, starved for combustion air or has worn injectors.
   - **Blue smoke** – forms when crankcase oil is burned in engine's combustion chambers due to worn rings, valve guides or seals.
   - **White smoke** – is a fog of very small fuel droplets due to poor quality fuel, injector/valve timing problem, burnt valves, or bad gaskets allowing coolant into the cylinders.
5. Instead of idling your engine to charge batteries, refrigerators and other electrical items, consider using solar, wind or tidal power, or use dockside power – learn more by checking out Renewable Energy Sources.

Did you know?

- Reducing power by as little as 10% from full throttle will save 20% in fuel costs.
- If you lower your fuel consumption, you'll make fewer trips to the fuel dock and save money!

OUTBOARD ENGINES

Outboard motors have come a long way. If you were to purchase an outboard engine prior to 2006, you would be shopping in a marketplace dominated by carbureted 2-stroke engines. In these traditional engines, the intake and exhaust ports are both open during the piston's downstroke. They lose 20 to 30 percent of their fuel as it passes straight through the combustion chamber unburned or partially burned, releasing it directly into the water and air as pollution.



Fortunately, shifting environmental and economic concerns generated the need for an outboard engine that is both clean and cost effective to operate. The U.S. EPA enacted emission standards for outboards that were phased in over nine years (1998 to 2006). All outboard, 2-stroke and even 4-stroke, manufacturers were required to up their standards to decrease the amount of pollution released. Here's how the eco-friendly outboards work:

Direct Fuel Injection (DFI) 2-Stroke Engine

The computerized DFI system precisely regulates the air-fuel mixture and directly injects fuel into the cylinder when the piston has risen up far enough to block the exhaust port. This prevents any unburned fuel from being blown out of the exhaust port.

4-Stroke Engine

In this engine, the air-fuel mixture flows into the combustion chamber via intake valves, and the exhaust leaves through exhaust valves. Both valves are never open simultaneously, preventing unburned fuel from escaping the combustion chamber and entering the environment.

Electric Engine

Electric motors convert battery power into propulsion. Even though electric engines are more expensive than other outboard engines, the operation costs are much lower. These engines are low maintenance, quiet, exhaust- and emission-free, and you don't have to worry about fuel and oil spills. They are limited due to the weight and size of the batteries needed to support the engine. However, the batteries can be charged by solar panels, wind or water generators (see Renewable Energy Sources for more information). Here are a few companies that offer electric outboard engines:

- Torqeedo (see photo below)
- The Ray Electric Outboards, Inc.
- Elco Motor Yachts
- Oceanvolt

Whether you want to power your canoe or a 50-foot center console, there is a wide range of options when choosing an outboard engine. Check out Marine Engines and Power Systems by boats.com for reviews on all types of outboards.

Did you know?

- California added two additional tiers of standards that are more stringent than the U.S. EPA's standards (Air Resources Board).

BIODIESEL

What's this type of biofuel?

Biodiesel is a renewable, non-toxic, clean-burning fuel, which can be a great alternative to conventional diesel. It's produced from seed oils (canola, sunflower, soybean, etc.) and can also be made from waste vegetable oil, animal fats and algae, which don't compete with food production. Biodiesel burns cleaner with reduced air emissions, including a decrease in soot, smoke, carbon monoxide and greenhouse gas emissions.

Generally, biodiesel is blended with petroleum diesel at different concentrations up to 20% biodiesel (B20). There will be a noticeable change in the odor and smoke in the exhaust from an engine using B20. As a result of cleaner emissions, there will be reduced air and water pollution from boats operated on biodiesel blends.

Do you need to modify your boat to use it?

Biodiesel is safer to handle, store and use, but before converting to this biofuel, check your engine's warranty. Very few (if any) modifications are needed before switching to this alternative fuel. Biodiesel can soften and dissolve natural rubber hoses and seals, so some people replace all lines, gaskets and seals with synthetics.

Biodiesel is also an excellent solvent, and will clean out your tanks and lines, so you will need to change your fuel filters more often. It's also important to note how often you go boating. If you rarely use your engine(s), biodiesel may not be the best alternative as it has a short storage life.

During the winter, it's recommended that biodiesel require the addition of a cold flow improver, which combats crystallization and allows for optimal flow performance in low temperatures. For the best cold weather performance, ask your fuel provider to ensure the correct blend. Find a retailer near you to get started.

Biodiesel in action

An intense double-handed, offshore sailing race held on the eastern seaboard (Charleston, SC to New York, NY to Portland, ME), the Atlantic Cup is one of the most environmentally sustainable races in the United States.

Teams were provided with sustainable fuel from waste vegetable oil from Newport Biodiesel. A B20 blend (20% biodiesel/80% unleaded) was used for instances when engines were necessary (e.g. help get boats from docks to the racecourse).

Did you know?

- Blends of biodiesel can also be used in your home heating furnace.
- Biodiesel reduces greenhouse gas emissions by 57-86% compared to petroleum diesel (U.S. EPA).

RENEWABLE ENERGY SOURCES

Energy for navigation, refrigeration, lights or other electrical items require a power source, but a boat's engine, will use almost as much fuel to charge batteries as it does when motoring. Idling your engine still produces emissions and pollutants that negatively affect our environment and our health. Running your engine purely for charging batteries can also harm your engine, as it is not designed to run below its rated level.

Both solar panels and a wind generator in use for energy.

A renewable source of generation is therefore a suitable alternative and a good safety backup. There are several types of systems you can use including wind generators, solar panels, water generators, or a combination. Some systems can keep your battery fully charged while your boat sits on the trailer, on a mooring or at the dock, or can be used during long journeys while you are underway.

Before choosing which renewable energy system is best for your needs, you first need to establish:

- What are you trying to accomplish (power navigation, run refrigeration, etc.)?
- How much electricity do you require?
- Do you need to modify your boat's electrical system to meet those requirements?
- Do you have the appropriate weather conditions (wind, sun, etc.) to "fuel" the generator?

It's always a good idea to consult with a well-trained professional for the best advice and options when dealing with any kind of electricity on your boat.

Wind: A wind generator has the potential to produce power 24 hours a day whether sailing or at anchor. If there's a strong wind, or you're underway, they can usually put out more current than solar panels. Wind generators, however, can be noisy, require regular maintenance and have the potential danger of rotating blades.

Sun: Solar panels can be used on small and large boats effectively, but will only produce power when the sun shines. The effective charging time is on average 5 to 7 hours per day, depending on where you operate your boat. Solar panels require minimal maintenance, don't make noise, last up to 25 years or more, and are safe. They do need space and special racks for mounting.

Water: Water-powered generators (hydrogenerators) use the motion between the moving hull and the water around you to produce ample amounts of electrical power. There are two main types: towed spinner generators and shaft generators. With both a minimum speed of 4 knots is recommended, as below this speed, the energy generated is negligible.

Photo credit: Oceanvolt

Did you know?

- Solar sails are being made around the world, where photovoltaic film is attached to each side of the sail. These sails are already being incorporated into the Arcona 380Z (see above), which is the first zero emissions cruising yacht and a joint venture of Arcona Yachts, Oceanvolt Electric Engines and UK Sailmakers.

ANCHORING

Determining the best places to anchor and cruise can be challenging without the proper navigational resources. Electronic charts are digital versions of the traditional government-issued paper charts (many boaters still carry these as back ups). For boats smaller than 40-50' it's recommended to use a waterproof chartplotter, but you'll have to select the brand of chart that fits your chartplotter (e.g. Garmin units operate Garmin's BlueChart g2 products). If you're using your personal computer or smart phone, there are many apps that utilize NOAA's electronic charts, where you can download the region that you will be boating around.

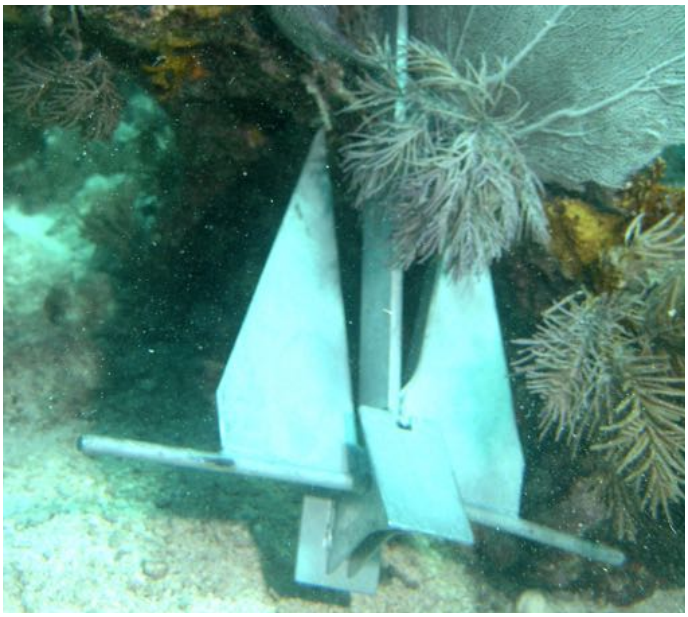
No matter what type of digital chart you decide to use, be sure to regularly update the program, as safety hazards including sunken vessels, shifting shoals, buoy changes, etc. are continuously added. This will help prevent potential groundings and other accidents.

Before you head out on a cruise, research the harbors where you plan on staying. If available, try to use existing mooring buoys before dropping the anchor. Check out Dockwa, it's an app that makes finding and reserving a mooring buoy or dock space easy.

If you plan to anchor, use your charts to assess bottom conditions and avoid areas that are home to sensitive or slow-growing species, such as shellfish beds, coral reefs and seagrass beds. Poor anchoring techniques can disturb or damage animals and plants on the seafloor.

Anchoring tips:

- Anchor in water deep enough to avoid grounding your vessel with tide change.
- If possible, anchor in sand or mud.
- If anchoring ashore, avoid sand dunes and don't tie your rope to a tree - they both protect inland areas from the destructive forces of wind and waves.
- If you revisit the same site frequently, try to anchor in the same position.



Retrieving anchor tips:

- Motor slowly toward the anchor and retrieve when the line is vertical.
- If the anchor is stuck, try to free it by hand, or disconnect it and mark the site with a buoy for a diver to retrieve later.
- Do not force the anchor free by motoring forward.

Did you know?

- There are two types of digital charts, raster and vector. Raster charts are essentially a digital picture of a paper chart, obtained through detailed scanning. Vector charts are stored as a database and drawn on the plotter screen by the software.

PROP SCAR PREVENTION

Healthy seagrass beds have a wide range of positive impacts for our waterways. The dense underwater meadows provide spawning and nursery habitats, areas of refuge, and feeding grounds for many fish and invertebrates. Marine animals, including green sea turtles and manatees, rely on seagrass for food and sustenance.

Seagrasses enhance water quality by absorbing excess nutrients and filtering water of pollutants and sediments. Many seagrass species produce an extensive network of roots and rhizomes that stabilize sediments to help protect the shoreline from erosion. These underwater plants also help mitigate climate change by capturing and storing significant amounts of carbon dioxide from the atmosphere.

Seagrass meadows are among the most productive ecosystems in the world, however, boating can have a devastating impact on these sensitive habitats if boaters don't take the proper precautions while navigating shallow waters.

What is prop scarring?

Seagrass scarring is caused by boats entering shallow waters where propellers, motors and hulls come into contact with seagrass beds. As the propeller slashes into the seafloor or the hull and motor drag across the bottom, it creates physical damage to the crucial root systems of the seagrass and leaves a visible scar in the seagrass bed.

Over time, erosion and scouring from waves and currents in damaged areas can result in scars expanding, causing additional loss of seagrass.

Recovery and growth of the seagrasses in scarred areas can take years, and if damage continues to occur, may never be able to recover. Prop scarring is a significant, but also preventable threat to crucial seagrass bed habitats.

How to protect seagrass?

- **Use navigational tools:** Review charts, fishing maps, or local boating guides to become familiar with your local waterways and learn where shallow waters are located. Operate your boat in marked channels or deeper water while under power.
- **Read the water:** While on the water, wear polarized sungalsses to reduce the surface glare, which will hep you see seagrass beds. Whenever possible, avoid those shallow areas.
- **Know your depth and draft:** If boating over seagrass in shallow water, be sure to trim your motor up and idle to a safe depth before getting on plane. Keep the times for low and high tides handy.
- **Stop the engine:** If aground, do not proceed under power. Turn off and trim up your motor. Pole or push your boat to a safe depth.

Did you know?

- In south Florida alone, more than 30,000 acres of seagrass have been damaged by boat-generated scarring.

BOATING NEAR MARINE WILDLIFE

One of the many joys of boating involves being able to see marine wildlife. However, encounters with boats can be dangerous or deadly for these beautiful creatures, and sometime hazardous for the boat too!

Before you go boating, research what types of marine wildlife may be living in or near your local waterways. Remember, some species are migratory. Here are some guidelines to follow to ensure that you have a memorable experience without disturbing wildlife.

How to view marine wildlife?

- Remain at least 100 yards (300 feet) away from all marine wildlife.
- Depending on the region in the U.S. and species, there may be stricter guidelines or laws (e.g. Under federal law, boats may not approach within 500 yards of a North Atlantic Right Whale, a critically endangered species with less than 500 individuals left).

Photo credit: NOAA

- Limit your viewing time to no more than 30 minutes. You may not be the only boat during the day to view the same animal. If another boat is already viewing, wait your turn and don't crowd the animal. Be careful not to trap the animal between yourself, other boats and the shore.
- If a marine mammal approaches you, reduce speed and put your engine into neutral. If sailing drop your sails and put your engine on in neutral. Do not re-engage until the animal has vacated the vicinity.
- Never chase an animal, try to stay behind them at all times and avoid sudden changes in speed and direction. Remember that whales and other marine mammals may surface in unpredictable locations.
- Be especially vigilant if you spot a mother and her young, and try not to separate them.
- If the animal exhibits behaviors that indicate it is stressed (erratic swimming pattern, aggressive behavior, prolonged diving, etc.), leave the area immediately.
- If you see a sick or injured animal, DO NOT attempt to aid or rescue it yourself.

How to view seabirds and shorebirds?

- Use binoculars to observe birds from a safe distance.

- Do not touch any bird. In most cases it is illegal for you to touch or otherwise physically disturb an active nest.
- Nest sites are especially vulnerable to human disturbance. If young birds are disturbed close to fledging, this often causes them to leave the nest prematurely.

Why is feeding wildlife harmful?

- Consuming unsuitable food endangers their health.
- Feeding changes their behavior, their migratory activity and decreases their need to forage for their usual food sources. These behaviors may be passed down to their young and other social group members.
- They lose their natural cautiousness of boats and humans and can become conditioned to receiving handouts. Some can then become aggressive and have the potential to bite or injure people when teased or expecting food.

What can you do for stranded or injured marine wildlife?

- For any entangled marine animals at sea, immediately call:
  - U.S. Coast Guard on VHF Channel 16 or
  - NOAA Marine Entanglement Hotline at 1-800-900-3622 or 866-755-NOAA.

Photo credit: International Fund for Animals

- For stranded marine animals, contact local authorities in your region specializing in:
  - Marine Mammals
  - Sea Turtles
- Be prepared to provide the following information:
  - Your name, address and phone number
  - Location and time of incident
  - What you saw (photos, video or a detailed description are invaluable)
  - Identification of animal if possible (include any marks or scars)
  - Animal's condition (weak, thin, etc.)
  - Weather conditions

Photo credit: NOAA PIFSC

What should you do if you have a collision with a marine animal?

- Immediately hail the U.S. Coast Guard on VHF Channel 16.
- Document as many details as possible.
- If the collision is with a whale, report the incident to the International Whaling Commission. The reports are confidential and are used to better understand migratory whale behavior.

Did you know?

- The Marine Mammal Protection Act of 1972 (MMPA) protects all marine mammals, including whales, dolphins, porpoises, seals, sea lions, manatees, dugongs, sea otters and polar bears within U.S. waters. People may not harass, feed, hunt, capture, collect or kill any marine mammal.

INVASIVE SPECIES PREVENTION

Aquatic invasive species (also called exotic or non-native) are plants and animals that invade an ecosystem where they don't belong. If the invasive species has no natural predators in its new environment, it causes damage by consuming native species, competing for food and space, or introducing disease. Some can even damage our boats!) Once they're established, an invasive species is almost impossible to eradicate.

Negative impacts:

- Reduce game fish populations
- Affect local economies of water-dependent communities
- Damage boat engines and seize steering equipment
- Reduce native species populations
- Degrade ecosystems
- Affect human health
- Reduce property values

How do they 'move'?

Larger ships transport invasive species in their ballast water, while fouling organisms such as barnacles, seaweeds and mussels can move from one location to another by hitching a ride on your boat, on items you use in the water and even your clothes. They also attach themselves to the millions of tons of plastics and other debris that floats with ocean currents around the globe.

How can you help?

The only way to stop an invasive species from causing harm is to prevent them from entering the environment in the first place. Any person enjoying a recreational activity in or on the water can play a key role in preventing the spread of invasive species.

1. Learn to identify invasive species in your area and report sightings to the proper authorities.
   - National Invasive Species Information Center (U.S. Department of Agriculture)
   - Invasive Species Specialist Group (IUCN)
   - Global Invasive Species Programme
2. Prevent and help clean up pollution on land and in the water.
3. Obey all related laws and educate others about the impacts of invasive species.

It's important for boaters to take extra care and properly clean their boats and equipment after each use, as invasive species can hide in common places, including the motor transom, livewell, anchor rope, boat hull, trailer and your clothes.

Tips for boaters:

- Remove all visible vegetation from your boat, propeller, anchor, trailer and any other equipment that was in the water.
- Drain and flush the motor, livewell, bilge and transom wells with hot water.
- Spray your boat and trailer with high-pressure water and then rinse with hot water.
- Dry your boat and equipment for at least 5 days before entering a different body of water.
- Larger vessels that spend months or longer in the water likely need to coat their hulls

in antifouling paint. For eco-friendly options, see Bottom Paint.

Tips for SCUBA divers and snorkelers:

- Inspect equipment for plants, mud or animals and remove any before you leave the area.
- Drain water from the buoyancy compensator, regulator, tank boot and any other equipment that holds water.
- Wash your suit and all equipment in hot water and dry completely.

Tips for fishers:

- Know and observe all live bait collection laws in your area.
- Never release live bait into a different body of water.
- Thoroughly wash and dry all fishing tackle, buckets, nets, waders, etc. after each use.
- Report any invasive species that you see or catch to the proper authorities.

Case Studies:

Zebra mussel (*Dreissena polymorpha*)
If you boat in freshwater lakes and rivers, you may be familiar with this invasive mollusk. One of the major concerns regarding zebra mussels is the ease at which it spreads.

Native to the Black and Caspian Sea, zebra mussels were first introduced into North America in the ballast water of ocean-going vessels, and have continued to spread to numerous lakes by overland transport, on hulls, anchors and trailers. They are also transported by divers' wetsuits, in scientific sampling equipment and fishing gear.

Zebra mussels cause significant harm to freshwater ecosystems by outcompeting native species for food and space and changing the whole ecology of the body of water. They can also clog water intakes and other pipes, and attach themselves to boat motors, hulls and docks.

European Water Chestnut (*Trapa natans*)
This invasive aquatic plant was released inadvertently by gardners into the waters of the Northeast in the late 1800s. The water chestnut's native range includes Europe, Asia and Africa, but is now spreading in waters throughout New England and the Mid-Atlantic states.

The water chestnut forms nearly impenetrable floating mats of vegetation, which can be a hazard for boaters. The plant also blocks light penetration into the water and outcompetes native aquatic vegetation.

Did you know?

- There are over 4,500 species of invasive plants and animals that have established populations in the U.S. Invasives put significant pressure on 42% of threatened and endangered U.S. species, and also have a significant human impact costing nearly $120 billion per year (Cornell University).

GREEN FISHING

Most anglers observe responsible fishing practices to lessen the impact on fish populations and to ensure that they are protected for the future.

The following are a few recommendations to help protect your local waterways and its inhabitants:

1. **Check your local rules** for fishing license, size and bag limit regulations, and only keep fish that you intend to eat.

2. **Choose your tackle wisely.** Try barbless hooks as they reduce the amount of handling needed to remove the hook. If using bait, use a circle hook as they have been shown to increase the survival of released fish.

3. **Try to keep your fight time short.** Long fights can cause exhaustion and make the fish vulnerable to injury and to predators.

4. **Handle fish with care** to minimize stress and harm. Use clean, wet hands when handling a fish to protect their mucous layer and scales. Always hold a fish so it is well supported and if you need to weigh it, use a cradle scale. Holding a fish by the eyes, lips or gills can cause damage. Minimize the length of time the fish is out of water to seconds, not minutes.

5. **Try to gently release fish without damage.** Use a dehooker if you can see the hook. This helps maintain the mucous layer on the fish. If you can't see the hook, cut the line as close to the hook as possible. Most fish are able to reject the hook, or the hook will dissolve over time.

6. **Protect the ecosystem.**
   - Unused bait, tackle or any other trash should be disposed of properly.
   - Use fish-cleaning stations and discard waste in regular trash or save fish waste to use as chum or bait. Do not throw fish waste into areas of high recreational use.

7. Recycle monofilament (single strand, strong and flexible plastic) fishing line. Marine mammals, sea turtles, fish and birds are injured or killed by entanglement or ingestion. Divers and swimmers are also at risk from entanglement and line can damage boat propellers. Much of this debris is cause by accidental breaks from lines snapping or rock snagging, so always try to recover your line.

8. **Prevent ghost fishing or cleanup abandoned fishing gear.** Derelict fishing equipment, often referred to as "ghost gear," is any discarded, lost, or abandoned fishing gear in the marine environment. It will continue to trap, entangle and potentially kill marine life, smother habitat and act as a hazard to navigation.

Did you know?

- Monofilament fishing line is not biodegradable and takes over 600 years to breakdown (U.S. National Park Service).
- Some tackle shops and marinas run a monofilament recycling program. If not, you can send it directly to Pure Fishing America (Berkley), 1900 18th Street, Spirit Lake, IA 51360-1041.

GREENING YOUR GALLEY

Whether you have a runabout boat or a large cruising vessel, food preparation will play a major role in the enjoyment of your trip.

Here's a list of suggestions to help green your galley:

1. Choose cookware and kitchen items that are reusable and will last. Try to avoid anything plastic and/or single-use.
   - **Cast iron cookware** is made to last multiple lifetimes, is naturally non-stick and lacks the hazardous chemicals found in Teflon. Cast iron can be used on a stovetop, in the oven and on a grill, so less cookware is required. It's also easy to clean with a stiff brush and hot water (no soap necessary).
   - **Stainless steel** is 100% recyclable. In fact, over 50% of new stainless steel is made from recycled scrap.
   - **Cook smart and heat smart:** Use the smallest sized pan for the task and the correct sized burner ring. Use lids to save energy.
   - **Glass containers:** Invest in good quality reusable glass containers – they can also be used in the microwave.
   - **Silicone bags:** Consider purchasing these type of reusable bags to store food.
   - **Wooden utensils**, bamboo in particular, are a good alternative to plastic as they are durable, don't harbor bacteria and germs like plastic, and are long lasting. Consider a bamboo cutting board as well.
   - Use **cloth napkins**.

2. Purchase and install energy efficient appliances.
   - **Refrigeration and icemakers:** Most boat refrigerators run on 12-volt systems and can be run by your main battery bank powered by renewable energy (solar, wind, or water generators) or shore power. Make sure your battery bank is sized for the load, in both a cool and warmer environment. Do not place your refrigerator next to your engine or generator, as it will heat up and require more power to keep cool.
   - **Freezer**: Whether you use a freezer box for day sailing or a built-in freezer for cruising, a full freezer is an efficient freezer. Minimize the time you need to keep the door open.

3. Efficient galley provisioning and organization can minimize waste, and save time and money.
   - **Plan ahead** by buying local and in bulk, reducing the amount of waste you produce.
   - **Do it yourself** and avoid buying pre-prepared foods. Making it yourself is healthier and there generally is less packaging waste.
   - Buy items in containers that can be **reused**, such as glass jars.
   - Purchase and use **green cleaners** to clean up your galley. Check out our Non-toxic Cleaning Products section for recommendations and DIY homemade cleaners.

Did you know?

- Plastic beverage bottles are consistently in the top five most collected items at beach clean-ups around the world (International Coastal Cleanup Project).

SUSTAINABLE SEAFOOD

Not very long ago, the abundance of fish in the ocean seemed to have no limit. However, today more than 75% of the world's fisheries are exploited, overexploited, or have already suffered a collapse.

Photo credit: G.Parsons, Greenpeace/Marine Photobank

Our choice in seafood is a chance for each of us to contribute to the ocean's restoration.

The Monterey Bay Aquarium's Seafood Watch program helps consumers choose seafood that's caught or farmed in ways that support healthy oceans, now and for future generations.

The choices we make as consumers drive the seafood marketplace. Your purchasing power can make a difference by supporting those fisheries and fish farms that are better for the environment, while at the same time relieving pressure on other fish species that are not doing as well.

How do you know what seafood to buy?

By using the seafood guide for your region, you're making choices based on the best available information and supporting environmentally friendly fisheries and aquaculture operations.

Monterey Bay Aquarium's Seafood Watch® recommends which seafood items are:

Best Choices: Buy this seafood first. They're well managed and caught or farmed in ways that cause little harm to habitats or other wildlife.

Good Alternatives: You can buy, however, be aware there are concerns with how they're caught or farmed.

Avoid: Don't buy. They're overfished, or caught or farmed in ways that harm other marine life or the environment.

The list is updated regularly to reflect any new information as it becomes available. To learn more, read our Ocean Watch article, Seafood Watch.

Download the Seafood Watch app!

Did you know?

- Oceans are a primary source of protein for more than 2.6 billion people (United Nations).

VACATION CARBON FOOTPRINT

When you're deciding where to go on your vacation, chances are that you choose a destination partly due to the beautiful environment. Tourism is dependent on intact ecosystems. Tropical beaches, vibrant coral reefs, beautiful vistas and other natural elements are key motivators for vacation choices.

Here is a list of simple things you can do to reduce your carbon footprint and help protect the place you are visiting:

1. **Reduce travel emissions:** Use public transportation, and if you need to rent a vehicle, choose a hybrid car. For shorter distances you could rent a bicycle or simply walk; you will be surprised at how much more you will notice along your route.

2. **Buy local:** A good way you get to know the local culture, enjoy new experiences and even save money is to buy and use local products and frequent local establishments. It's often a rewarding choice, not only in terms of financial and carbon savings, but because of the unforgettable experiences you gain. If it's locally grown, it didn't have to travel that far, whereas imported products are a huge contributor to global carbon emissions.

3. **Pay attention to packaging:** Purchase products with minimal packaging and take reusable bags for carrying your goods. For example, you may chose to buy the loose mangos, rather than boxed or plastic-wrapped ones.

4. **Ditch bottled water:** Bottled water has a huge carbon footprint. Rely on a reusable water bottle and when you visit restaurants and bars, ask for their own filtered water rather than bottled water.

5. **Reduce your water consumption:** In many tropical countries, water is as precious as gold, and its supply is limited. You can make a huge difference by taking shorter showers and turning off the water when brushing your teeth.

6. **Engage in low-impact recreation:** While enjoying the outdoors, consider walking and biking instead of renting a scooter. Enjoy the water by sailing, kayaking, snorkeling or surfing instead of speed boating or jet-skiing. These small changes can greatly reduce your emissions.

7. **Conserve electricity:** Unplug appliances that you don't use frequently. Turn down your air-conditioning (if using), and be sure to turn off the lights when leaving a room.

8. **Leave it better than you found it:** Pick up trash as you go, volunteer for a beach cleanup day or make a donation to a local environmental organization. Support local efforts to improve the environment and leave your vacation feeling good about your experience.

Did you know?

- If you are flying to your destination, you can offset the carbon footprint of your airplane travel. Check out The Ocean Foundation's Seagrass Grow, which plants seagrass to offset your carbon emissions.

SPRING PREPARATION

Winter is over and it's that time of year to take boats out of storage! Annual preparation and cleaning will help prevent problems once you hit the water – and there are ways to be green while doing it.

If you properly winterized your boat at the end of the season, you shouldn't have too much to do before launching it into the water.

Here are a few steps you can take to make sure the preparations for launching your boat are more environmentally friendly:

Uncovering

- If you used shrinkwrap, you can recycle it!
  - Remove strapping, lumber, nails, zippers, vents and other materials.
  - Keep shrinkwrap as clean as possible.
  - Check with your marina if you should roll or bag the shrinkwrap.
- Give your boat a good cleaning. See the Non-toxic Cleaning section for the most effective and eco-friendly options.

Engine(s)

- If you didn't before the winter, change the oil and filter, and perform routine maintenance on the engine.
- Remove antifreeze from your water and cooling systems.
- Both engine oil and antifreeze can be recycled.

  Check out the Engine Maintenance for waste disposal instructions and see if your marina has the proper waste receptacles.

Batteries

- Charge all batteries and install them.
- If you are looking to purchase new ones, check out our Batteries section for tips on which ones to buy.

Hull

- Prep the bottom of your boat using a wet or vacuum sander, and be sure to follow your bottom coat's manual for proper instructions.
- Use eco-friendly hull paints to coat the bottom of your boat (see Bottom Paint).

Enjoy the boating season!

Did you know?

- The shrinkwrap needed to cover a 20-foot boat weighs approximately 25 pounds, which is the equivalent to using 2,250 single-use plastic bags. A reusable canvas cover is a sustainable alternative.

GENERAL MAINTENANCE

One of the best ways to protect our local aquatic ecosystems is by proactively managing our vessels. This not only reduces harmful environmental impacts, but will also extend your engine and boat's life, and helps to protect you while on the water.

Preventive boat maintenance before and after each outing is recommended and this can easily be achieved by creating a checklist.

The items listed below only cover points that might directly impact the environment. It's not a comprehensive list for overall boat maintenance.

Before Each Trip:

- Inspect the boat hull and engine cases for leaks or damage.
- Check the propeller (impeller on jet drives) for signs of damage. A faulty propeller will not operate efficiently and will cost more in fuel and overall repairs. Also, make sure no rope or lines are caught up in the propeller, as these could cut through the lower gearcase propeller shaft seal.
- Examine the gearcase for leakage. If oil is leaking out of the gearcase, check to see if the oil is contaminated.
- Check that the bilges are clean and dry, investigate any leaks and check that the bilge pump works.
- Check that the bungs are not worn and that the washers are in good condition.
- Make sure all seacocks are functional.
- Inspect all anodes for signs of wear and tear.
- Look for corrosion around electrical systems, and make sure that they are kept clean and greased.
- If any damage or problems are detected, quickly address any required maintenance.

After Every Trip:

- Flush your outboard engine each time it's used with freshwater. Use earmuffs (an attachment with two flexible rubber seals connected with a metal clamp) over the water intake and a freshwater hose. Tilt engine and rinse underneath to prevent salt buildup.
- Rinse your boat and trailer. If possible, try using water-only wash downs (see Graywater). If you must use detergents, be sure to use Non-toxic Cleaning Products.

For more specific information, check out other topics under Boat Maintenance (e.g. Engine Maintenance, Batteries, Bilge Maintenance) and refer to your manufacturers' manuals.

Did you know?

- A clean hull can save you up to 20% in fuel each year, reducing your carbon emissions and keeping money in your wallet.

ENGINE MAINTENANCE

Routine engine maintenance is important to optimize proper performance, fuel efficiency, clean exhaust, to protect water quality and to spend more time enjoying your waterways.

Try creating and following a service schedule for your engine and check your owner's manual for specific products and instructions.

Fuel

- Check fuel lines, tanks and vents for any signs of corrosion or damage.
- Change fuel filters (removes particles/debris) and fuel separators (removes moisture) regularly and have injectors inspected annually.
- Always carry spare fuel filters.

Oil

- Oil should be changed regularly. Create a step-by-step plan to reduce any possible accidents.
- Temporarily disable your bilge pump. After you change your oil, turn the pump back on once you have checked for any contaminated oil.
- Use a closed system to transfer oil and place a strong bag around the filter when removing to decrease your chance of a spill.
- Keep an oil absorption pad below the engine to catch leaks and wipe up any spills.
- Always carry spare oil filters.
- When handled properly, oil and oil filters can be recycled. Check with your marina or use Earth911.org.

Air

- If your engine has an air filter, make sure it is cleaned or changed regularly.
- Make sure air ducts are free from obstruction.
- Carry spare air filters.

Water

- Check coolant levels before each trip. The use of antifreeze/coolant in your engine helps to transfer heat away from the engine, thereby allowing the engine to operate at maximum efficiency. Propylene glycol antifreeze (orange-pink color) however, is non-toxic, and has been proven to improve cooling by an estimated 60%. Antifreeze should be recycled (check your marina) and not poured down the drain or onto the ground.
- Check impellers and stopcocks for correct operation.
- Check pipes and hoses for a buildup of organisms that block/reduce flow.
- Inspect overboard discharge for correct flow without any contaminants (oil/fuel).

Waste Disposal

- Use non-VOC (Volatile Organic Compound) solvents to wash engine parts and tools and place them in a container where the dirty liquids can be collected, and recycled or disposed.
- Never dump waste oils, engine coolants or other toxic chemicals on the ground, into storm drains and dumpsters, or open waters.
- Avoid mixing different hazardous liquids, which may make them unacceptable for recycling.
- Ask your marina about disposal facilities for waste oils and associated byproducts.

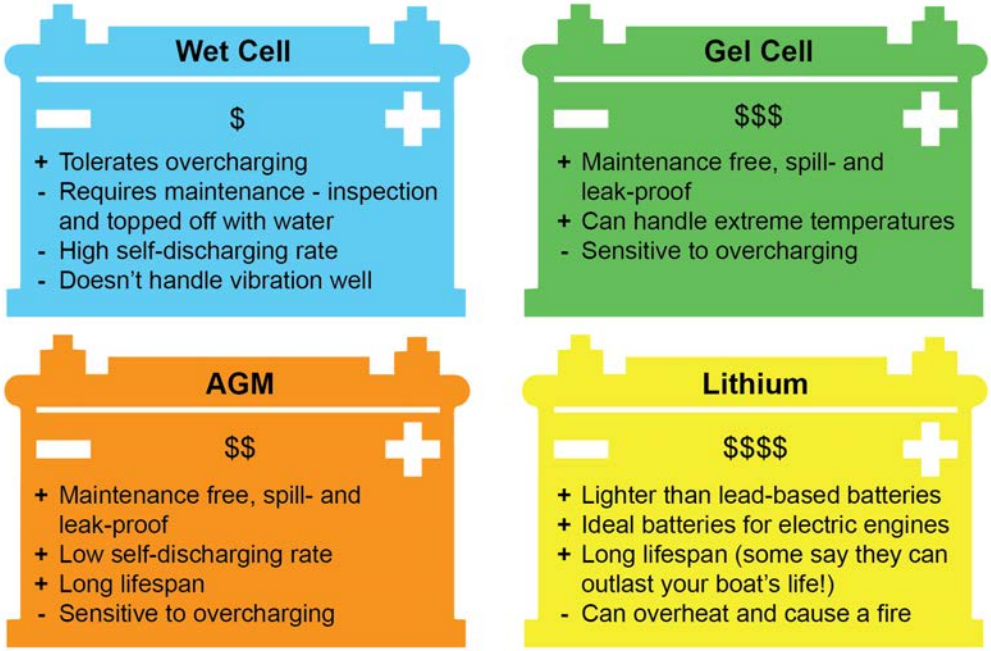
Did you know?

- Used oil from one oil change can contaminate 1,000,000 gallons of water (U.S. EPA).
- Most antifreeze (blue-green color) is highly toxic, poisoning an estimated 90,000 animals and 6,000 people in the U.S. each year (Humane Society of the United States and American Association of Poison Control Centers).

BATTERIES

Choosing the right size battery for your boat and performing routine maintenance will ensure the optimal lifespan of your battery and will save you money. Check your engine manual for the recommended battery rating. Many boats will need two types of batteries, an engine starting battery and a deep cycle battery for powering navigation, lights and domestic equipment. Dual types are manufactured, but are usually only suited for small powerboats or sailboats.

There are four different chemical types of marine batteries: wet cell (flooded), gel cell, absorbed glass mat (AGM), which are all lead-acid batteries, and lithium. The type you choose is based on your needs (engine starting versus deep cycle), the capacity and lifespan you are looking for and your budget.



The most versatile type for marine use is the AGM battery. If you don't use your vessel daily, AGMs will hold their charge better than wet and gel cell batteries. Long lifespan and low self-discharge rate make AGM excellent dual-purpose (deep cycle and engine starting) batteries for boats.

Battery tips:

- For all batteries onboard, stick with one chemistry (e.g. AGM). Each battery type requires specific charging voltages and mixing types can cause under- or over-charging.
- Never mix old batteries with new ones in the same bank. Old batteries tend to pull down the new ones to their deteriorated level.
- Maintenance extends battery life.
  - For wet cell batteries, frequently check the water levels and top-off with distilled water as needed. Fill up after charging as water levels rise during a charge.
  - Disconnect your battery when not in use.
  - Beginning of season – Charge and check for connection corrosion.
  - End of season – Remove batteries for storage, clean top surfaces, grease terminal bolts and store in a dry, cool area.
- If possible, use solar, wind or water power to trickle charge your batteries (See Renewable Energy).

Did you know?

- Lead batteries top the list as the most highly recycled consumer product, with more than 98% of battery lead being recycled due to its closed loop cycle. Find your neighborhood-recycling agent by zip code.

BILGE MAINTENANCE

The bilge is the lowest internal part of your boat's hull, where water collects, along with spilt and leaked fuel, oil, antifreeze and other toxic liquids. Any accidental discharge of oil is both illegal and detrimental to the ocean as it is toxic to marine plants and animals.

Photo credit: James Mitchell

Conducting regular bilge inspections and quickly addressing any required maintenance will prevent oils from sneaking into the ocean.

How to prevent bilge pollution?

- Check for unusual growth, unpleasant odor and mildew.
- Check limber holes (drain holes through the frame of a boat) are clear to ensure water and other liquids can pass freely.
- Keep your engine tuned.
  - Change oil filters often.
  - Check seals, clamps, gaskets and filter connections for leaks and drips.
  - Inspect hoses for peeling or cracking.
  - If you see any fuel, oil or other liquid spills, wipe up immediately.
- Secure an oil-absorbent pad under your engine and an absorbent bilge sock next to (but not interfering with) your bilge pump.
- Discard used oil pads and bilge socks as hazardous waste following state and local regulations.
- Consider installing an oil/water separator.
- If there is too much oil for a bilge sock to absorb, remove oily water at a bilge pumpout station.
- Do not use dish soaps to make a spill disappear. It causes the oil to break down into tiny particles, which if pumped out, make the spill much harder to contain and clean up. Dish soap can also be toxic to marine life.

Which oil absorbing bilge pads work best?

Duke Marine Lab in North Carolina and BoatU.S. Foundation conducted independent testing of 21 bilge pads. They found that many of the products sold were not effective and some were highly toxic. The 3 products below were the most efficient and had low toxicity levels:

1. West Marine Bilge Absorber Boom

2. CI Agent Marine Pillow

3. Enviro-Bond 403 Bilge Sock

In addition, Centek Industries has developed a system, BilgeKleen, to filter hydrocarbon pollution from bilge and generator water discharge.

Did you know?

- Bioremediation is a treatment that uses naturally occuring organisms to break down hazardous substances (e.g. oil) into less toxic substances. Oil-eating bacteria ingest the oil, turning it into a harmless substance. It's a good long-term treatment for oil, but is ineffective for spills. Check out NavalKleen Small Craft Formula.

WINTERIZING YOUR BOAT

Properly winterizing and storing your boat will help prevent damage and make sure you are ready for on-the-water fun in the spring. Consult your manufacturers' manuals and service guides for specific winterizing, flushing and maintenance instructions before you begin. Plan ahead, create a checklist (see below) and gather all the items you will need to winterize and store your boat.

Engine(s)

- Fill fuel tanks, add stabilizer, and change fuel filters and separators.
- Change oil and filter.
- Check coolant level in freshwater-cooling system and add coolant as necessary.
- Run antifreeze through raw-water-cooling system. Use propylene glycol antifreeze (orange-pink color) as it's non-toxic.
- Dispose of and/or recycle waste oils, engine coolants and hazardous materials properly.

Outboards

- Fill fuel tanks and add stabilizer.
- Drain gear case and add eco-friendly lubricant.
- Flush engine using an "ear-muff' device.

Batteries

- If you take your batteries home, store them in a cool, dry place such as your basement and put them on a trickle marine charger.
- If you leave your batteries onboard, make sure battery cable connections are tight and free of corrosion, and hook batteries up to a marine charger, or leave them unplugged and charge them completely at least once a month.

Below Deck

- Clean and dry bilges, and verify pump operates properly.
- Pump out holding tank and add propylene glycol antifreeze to the head.
- Drain all systems that use water (e.g. freshwater system, shower sump) and replace with propylene glycol antifreeze as appropriate.
- Remove all food and beverages, and clean food particles that may tempt winter critters.
- Secure all ports and hatches.

Store in the Water

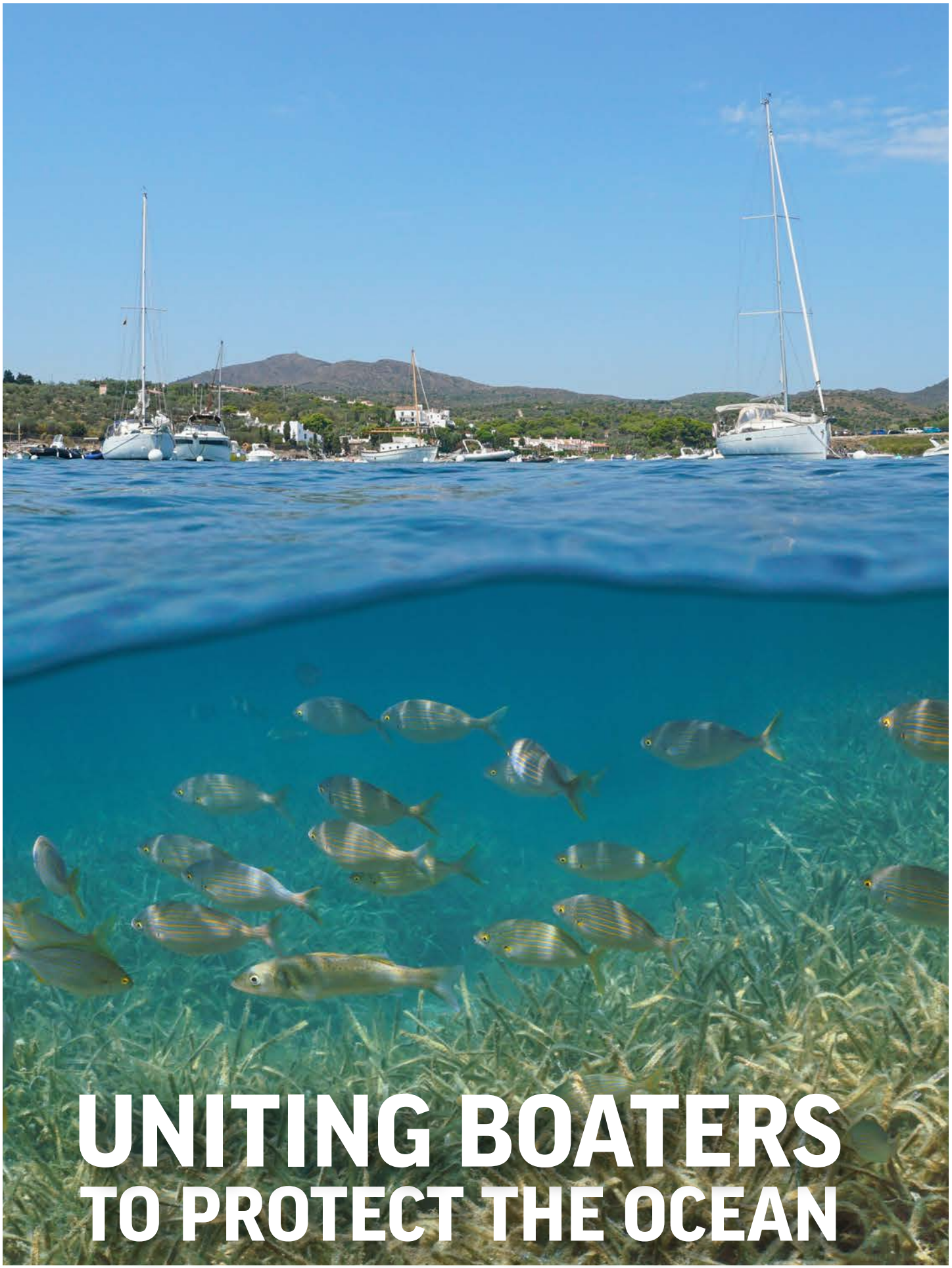
- Close all seacocks except for cockpit drains and plug exhaust ports.
- Check docklines, chafe guards and fenders for proper placement, and tie off tiller or steering wheel.

Covering

- Custom-made canvas or synthetic covers
  - Best at protecting your boat from the elements, is reusable and saves money.
  - Allows for air circulation – prevents mildew.
- Shrinkwrap
  - Effective at keeping rain and snow out, but susceptible to moisture buildup.
  - Professionals should shrinkwrap your boat, as it's easy to damage your boat and/or ignite the shrinkwrap.
- If using a different covering, make sure that it's water/snow proof, and there's air flow.

Did you know?

- Analyzing over ten years of freeze claims, BoatU.S. Marine Insurance found that more than 3/4 of the claims involved cracks in the engine block or the exhaust manifolds that occurred because water remained in the engine or cooling system during a hard freeze.



UNITING BOATERS TO PROTECT THE OCEAN