SAILORS FOR THE SEA

GREEN BOATING GUIDE

THE GO-TO GUIDE FOR ECO-FRIENDLY BOATING

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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.
Marine Scientist
Education Director
Sailors for the Sea

Thanks to MJM Yachts' sponsorship for helping create a powerful wave of change!

ACKNOWLEDGEMENTS

SAILORS FOR THE SEA

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SPECIAL THANKS TO

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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.

TABLE OF CONTENTS

POLLUTION PREVENTION

SPILLPROOF FUELING

Filling up our tanks is the most common way that we unintentionally pollute our waters. In fact, 85% of petroleum that enters North American waters each year is a result of human activities including land-based runoff, airplanes and recreational boats (National Academy of Sciences). Even a tiny fuel spill is toxic to the aquatic environment, 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 pristine. For proper fueling procedures, follow these steps:

Before:

- Check fuel lines and tanks for cracks, signs of corrosion or damage, and leaks.
- Have absorbent bibs, collar and a spill kit on hand to catch any potential drips or a spill.
- 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:

- Turn off the engine(s), electronics and extinguish any open flames.
- Place an absorbent bib or collar around the fuel intake to catch drips or any overflow.
- Position yourself so you can see the deck fill and comfortably hold the nozzle in contact with the edge of the fill to prevent buildup of static electricity and sparking.
- Fill tank slowly and listen for a change in tone as the tank 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 automatic shut-off nozzle rarely works.

After:

- Wipe up any accidental spills and dispose of rags, absorbent bibs or collars as hazardous waste.

Portable Fuel Cans:

The transportation and transfer of fuel with portable fuel cans (aka jerrycans) often leads to accidental fuel spills. According to the U.S. Environmental Protection Agency (EPA), an estimated 70,262 gallons of fuel is spilled by the use of jerrycans each year. All new jerrycans

sold in the U.S. must meet a set of regulations. Although they fill more slowly, the new jerrycans decrease vapors from escaping into the atmosphere and minimize fuel spills. Always fill jerrycans ashore on level ground (not in the back of your truck or on your boat), where spills are less likely to occur and easier to clean up.

OIL & FUEL SPILLS

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

1. First identify the cause and source of the spill and if possible, stop the source immediately. Remember, fuel leaks are dangerous – they can cause fire or an explosion.

2. Notify the marina or fuel dock (if applicable), as they should have oil absorbent pads and booms to contain the spill. Make sure you dispose of used absorbent materials as hazardous waste.

3. Call the U.S. Coast Guard National Response Center at **1-800-424-8802**. You may need to provide:
   - Location of the incident
   - Cause or source of spill
   - Type of fuel spilled
   - Amount of fuel spilled
   - Level of danger or threat
   - Weather conditions at location

4. Lastly, but most importantly, do not attempt to clean up a spill by yourself. Each spill will be handled differently, so it is best to get advice from the marina and/or the U.S. Coast Guard. **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. This makes the spill harder to clean up and ultimately more toxic to marine life because of the additional chemicals. Remember, under Federal Law (33 USC 1321) you are liable for civil and/or criminal penalties if you cause any type of oil or hazardous substance spill.

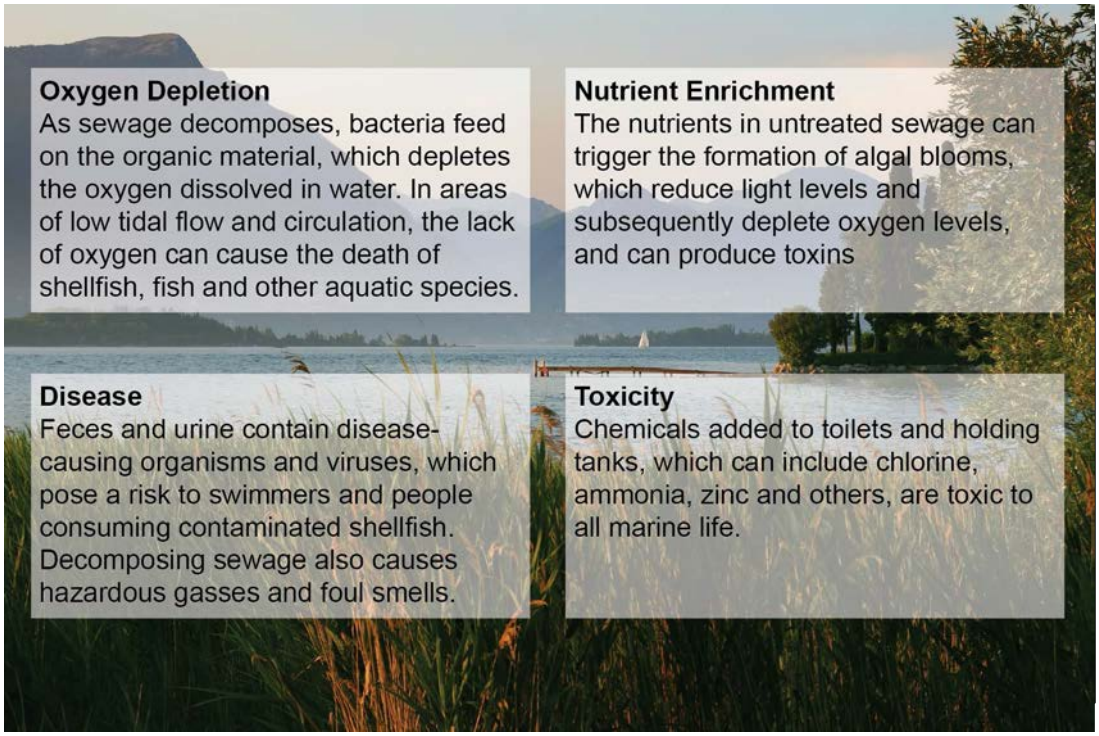
Photo credit: Maria Petuelie/ Marine Photobank

BLACKWATER

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.

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)!

How does blackwater pollution affect aquatic environments?



Under federal law, **it is 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 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 is 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.

How to prevent blackwater pollution?

There are several ways to handle waste onboard:

- **Installed toilet with a Marine Sanitation Device (MSD)** – the most common type for recreational boaters is MSD Type III, which consists of a holding tank that doesn't have an overboard discharge pipe and can only be emptied at a pumpout facility. Offshore recreational boats generally use MSD Type I, while MSD Type II are found on large commercial vessels. Both types have the capability to pump treated sewage overboard. All MSDs should be U.S. Coast Guard approved.
- **Portable toilet (porta-potty)** – does not use installed water or power.
- **Composting toilet** – does not require the use of a holding tank or pumpout facility. Nature's Head and Air Head Dry Toilet are recommended for use on boats.

If you are traveling in areas that do not have pumpout facilities (i.e. Caribbean), 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 water operators, and those who eat the local fish and shellfish.

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 now have a no-discharge policy.

Why is this a problem?

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 and other aquatic life to suffocate, resulting in dead zones.

Solutions:

- Always research your cleaners (see Non-toxic Cleaning Products for 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 in the garbage.
- Whenever possible, use shoreside facilities for showering, laundry, dishwashing, etc.
- When at sea, retain your graywater for a pumpout facility or treat graywater as if it were sewage, and only discharge if you're at least 3 miles offshore.
- Clean your boat with water-only washes, as most of the dirt on a boat can be removed with a brush and water.

WASTE DISPOSAL & RECYCLING

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.

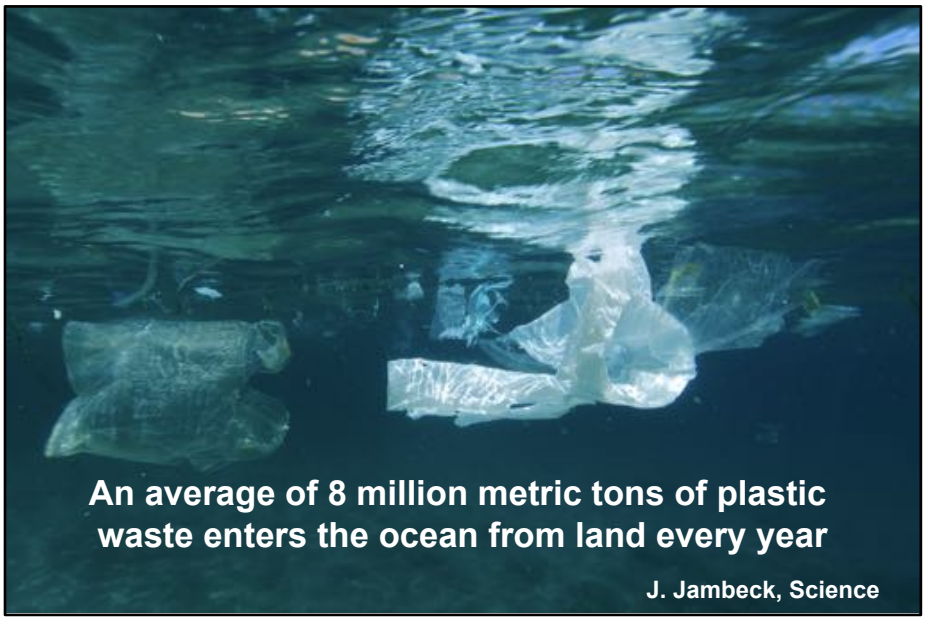


Photo Credit: Gavin Parsons, Greenpeace/ Marine Photobank

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. In fact, 693 different species have encountered marine debris, with many of them suffering from entanglement and ingestion (Plymouth University). 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. Accidently 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.

- Choose products sold in recycled and recyclable containers.
- Use reusable containers and items whenever possible.

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.
- Cut six-pack rings and similar items so that they do not become a noose for wildlife.
- Practice Plus One Boating - bring back what you take out, plus one trash item you find.

Back on land:

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

REDUCE YOUR IMPACT

CARBON FOOTPRINT

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, however, 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, oysters and clams to build shells. Oceans also face elevated temperatures and rising sea levels due to the warming of the atmosphere.

Without conscious effort, carbon dioxide concentrations will continue to rise in the atmosphere and our ocean ecosystems will suffer. We can take personal action to decrease CO_2 emissions and help protect our ocean for future generations.

Carbon Footprint:
A carbon footprint calculates the greenhouse gases we 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 personal carbon footprint by improving

the energy efficiency in our homes, on our boats, and by purchasing local products and changing our consumption patterns.

How to Calculate 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. Each boat 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. The easiest route to estimating your boat's footprint is by keeping track of your fuel usage. To calculate your carbon footprint, determine 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. 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: If you use 10 gallons per hour and you ran your engine for 204 hours during the year, your calculation would be: 10 x 204 = 2040 gallons. If your fuel type is marine diesel, you then multiply 2040 gallons by 21.24 = 43,329 lb (43.3 tons) of CO_2.

The key to lowering your boat's carbon footprint is to decrease your fuel consumption! Try purchasing an efficient, low pollution engine, reducing your fuel use or using renewable energy.

Offsetting Your Carbon Footprint:
Purchasing carbon offsets is another way 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 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. And they focus their replanting efforts on areas that have been damaged by boat propellers and anchors.

Photo Credit: Ed Bierman

OUTBOARD ENGINES

Outboard motors have come a long way. If you were to purchase an outboard engine prior to 2008, 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 have generated the need for an outboard engine that is both clean and cost effective to operate. Here are more environmentally friendly outboard options:

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. The DFI 2-stroke engine technology is not as efficient as a 4-stroke engine, but it's much cleaner than the carbureted 2-stroke engine and reduces oil use by 50 percent.

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. A 4-stroke engine is usually heavier than a 2-stroke of the same horsepower, but manufacturers continue to pursue new ways to lighten the engines.

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 and/or services:

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

BIODIESEL

Biodiesel is a renewable, non-toxic, clean-burning fuel, which can be a great alternative to conventional diesel. It is 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.

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.

To find a retailer near you, visit http://biodiesel.org/using-biodiesel/finding-biodiesel.

REDUCE FUEL USAGE

How you take care of and drive your vessel has a large effect on how much fuel you use. These tips will help you save money and reduce pollution!

Before Your Trip:

- Perform routine engine maintenance.
    - Change fuel filters regularly, they remove unwanted particles, increasing engine efficiency.
    - Fuel additives clean engine parts, breaking down potentially harmful substances.
- Check your propeller (prop).
    - Make sure you have the correct prop for your vessel type and how you use it.
    - Look for bent blades, dings or eroded edges, as damage will increase fuel usage.
- Maintain the bottom of your vessel.
    - Regularly clean the bottom of your boat. Marine growth on your hull increases friction, therefore slowing your boat down and wasting fuel.
    - Bottom antifouling paint can prevent growth on your hull. For environmentally friendly recommendations, see Bottom Paint.

- 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 keep good records so you can monitor vessel performance after changes are made to your boat.
- Plan ahead.
    - Know exactly where you're going on your trip, thereby minimizing journey time.
    - Tides and winds are not only relevant to sailboats, but also to power vessels. Boating against the tide or into strong winds requires more engine power than moving with the tide or wind.
- Decrease extra weight onboard to lower fuel consumption.
    - When filling up your fuel and water tanks, only carry the amount you need for your trip.
    - Empty your holding tank often.
    - Bring and/or store only the items you need onboard.

During Your Trip:

- Slower speeds on the water will decrease fuel usage.
    - Reducing power by as little as 10% from full throttle will save 20% in fuel costs.
- Using trim tabs and power trim carefully prevents plowing and reduces drag. This allows the boat to plane at a lower rpm, run more quietly and saves money.
- 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 to create a smaller wake, or quickly speed up to plane thereby creating a smaller wake.
- Instead of idling your engine to charge batteries, refrigerators and other electrical items, consider using solar, wind or tidal power, or use dockside power.

RENEWABLE ENERGY SOURCES

Energy for navigation, refrigeration, lights or other electrical items require a power source, but a boat's engine, which is the usual choice, 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.

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 is a strong wind, or you are 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.


Catamaran using both solar panels and a wind generator for energy.

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, however, need space and special racks for mounting.

Water: Water-powered generators (hydrogenerators) can also be a cost-effective source of charging your batteries. The motion between the moving hull and the water around you can produce ample amounts of electrical power. There are two main types: towed spinner generators and shaft generators. With both, however, a minimum speed of 4 knots is recommended, as below this speed, the energy generated is negligible.


Photo Credit: Oceanvolt

Solar Sails – Future Solution?
Several manufacturers around the world are creating solar sails where photovoltaic film is attached to each side of the sail. These sails are already being incorporated into a new production yacht, the Arcona 380Z, which is the first zero emissions cruising yacht and joint venture of Arcona Yachts of Sweden, Oceanvolt Electric Engines of Finland and UK Sailmakers.

ECO-FRIENDLY PRODUCTS

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 very important.

Manufacturers of chemical products are not required to list ingredients on their containers or make them public, so it's important to take the time to do your research before you purchase a cleaning product. Labels on cleaners can be confusing and words like "natural", "non-toxic", "organic" or "biodegradable" are misleading because there is no regulation of the words' use.

Use the following programs to ensure that your cleaner is safe and environmentally friendly:

- The U.S. EPA's Design for Environment (DfE) created the **Safer Choice label**, which means the product has been through a rigorous review. EPA scientists evaluate every ingredient in the product to ensure it meets their stringent criteria. Additionally, the EPA creates partnerships with manufacturers and formulators to produce products, whose ingredients, when compared to conventional formulations, are less toxic, less persistent (biodegrade faster), less bioaccumulative (don't build up in living tissue of humans or animals) and whose byproducts have similar beneficial characteristics.

- The Environmental Working Group (EWG) is a nonprofit organization dedicated to protecting human health and the environment. EWG's scientists compare the ingredients listed on cleaning product labels, websites and worker safety documents with the information available in 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.

BoatU.S. Foundation tested 20 different "green" boat soaps to see if the products lived up to their environmental claims while still cleaning a vessel effectively. Based on their research and weighing all the factors (cleaning, performance, toxicity and biodegradability), here are the top products:

- Thetford Marine Boat Wash (1st place!)
- Concrobium XT Eco-Wash
- Meguiar's Mirror Glaze Boat Gel Wash
- Shurhold's Yacht Brite Wash

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

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: algae, slime, seaweed, barnacles, mussels and others. 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: ablative, hard and hybrid paints. 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 damages the larval stages of aquatic invertebrates and fish species. 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). Marinas and protected anchorages with little current or tidal movement are particularly vulnerable, as they allow the buildup of copper to toxic levels.

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:

- Hempasil X3 (87500) - Hempel USA
- Intersleek Pro (replaced Intersleek 900) - Interlux

These two paints are nonbiocides, which are commonly formulated with silicon compounds and are designed to present 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 bottom antifouling paint is best for your boat?
It's important to understand how alternative hull paints work, and the short- and long-term costs. The following factors should be considered:

- What type of boat you own and the frequency of use

- 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 is 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. Always wet sand or use a vacuum sander to remove old paint.
- When you have finished, collect any waste for disposal in a hazardous waste receptacle.

Tips for applying new bottom antifouling 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.

GREEN YOUR GETAWAY

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, will last and are kind to the environment. Avoid anything plastic and single-use, as it may accidentally end up in the water and is harmful to marine life.
   - **Cast iron** cookware is made to last multiple lifetimes. It's 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, so it's an eco-friendly option.
   - **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.
   - **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 is less packaging waste.
   - Buy items you can **recycle**.
   - Purchase and use **green cleaning** products. To find the most environmentally friendly ones, see Non-toxic Cleaning Products.

SUSTAINABLE SEAFOOD

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. With more than 75 percent of the world's fisheries either fully fished or overfished, these issues are more important than ever (Food and Agriculture Organization of the United Nations). 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.

Download the Seafood Watch app! The list is updated regularly to reflect any new information as it becomes available.

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. What would happen if something negatively impacted your favorite location? What if there were things you could do to keep our precious environments pristine?

Here is a list of simple things you can do to reduce your carbon footprint:

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.

WILDLIFE AND HABITAT PROTECTION

ANCHORING

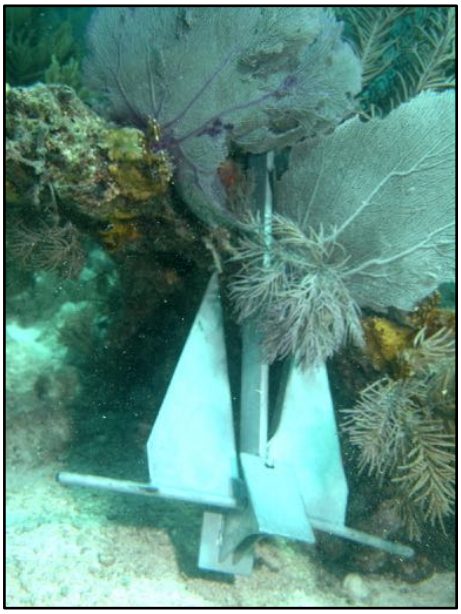


Photo Credit: Joe Bartoszek 2010/ Marine Photobank

Boaters can harm aquatic habitats and wildlife through poor anchoring techniques that disturb or damage animals and plants on the seafloor. The effects are of most concern in areas that are home to sensitive or slow-growing species, such as shellfish beds, coral reefs and seagrass beds. **Did you know?** Although coral reefs cover less than 2% of the ocean bottom, they provide food and shelter to up to a quarter of all ocean species (Smithsonian National Museum of Natural History).

Helpful tips when anchoring:

- Use existing mooring buoys if available.
- Anchor in water deep enough to avoid grounding your vessel with tide change.
- If possible, anchor in sand or mud and avoid sensitive, important ecosystems, such as coral reefs, shellfish and seagrass beds.
- If anchoring ashore, carefully place the anchor to minimize coastal damage. 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 visit the same site frequently, try to anchor in the same spot.

When retrieving your anchor:

- 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.

Nautical charts can help you identify proper places to cruise and anchor. The color of the water can also give you a good indication of what is below the surface. Shallow waters with bottom formations and seagrass beds look brown, while deeper waters appear green or blue. Always navigate with caution in deeper waters as reefs and rocks can rise abruptly. Sand bars and shallow rubble areas look white and can be deceiving as they may be much shallower than they appear. Use this old mariner's saying to help you remember where to cruise:

Brown, Brown, Run Aground
White, White, You Just Might
Green, Green, Nice and Clean
Blue, Blue, Cruise on Through

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! Here are some guidelines to follow to ensure that you have a memorable experience without disturbing wildlife.

Viewing Marine Wildlife:

- Remain **at least 100 yards (300 feet) away** from all marine wildlife.
- 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. 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 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.

Viewing 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.

Do not feed any marine wildlife, as it is harmful because:

- 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 stranded marine animals, contact local authorities in your region specializing in:
  - Marine Mammals
  - Sea Turtles
- For any entangled marine animals at sea, immediately call the NOAA Marine Entanglement Hotline at 1-800-900-3622 or 866-755-NOAA or hail the U.S. Coast Guard on VHF Channel 16.
- 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

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. Once they're established, an invasive species is almost impossible to eradicate.

There are over 4,500 species of invasive plants and animals that have established populations in the United States, and this number increases yearly. Invasive species put significant pressure on about 42% of threatened and endangered species in the United States, and also have a significant human impact costing nearly $120 billion per year (Cornell University).

Negative impacts:

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

- Learn to identify invasive species in your area and report sightings to the proper authorities (i.e. U.S. Department of Agriculture's National Invasive Species Information Center).
- Prevent and help clean up pollution on land and in the water.
- Obey all related laws and educate others about the impacts of invasive species.

Tips for boaters:

- Remove all visible vegetation from your boat, propeller, anchor, ropes, 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 new body of water.
- Larger vessels that spend months or longer in the water likely need to coat their hulls in antifouling paint. See Bottom Paint for environmentally friendly options.

Tips for SCUBA divers and snorkelers:

- Inspect and remove plants, animals and mud from your equipment.
- 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.

Zebra mussel (*Dreissena polymorpha*)
If you boat in freshwater, you may be familiar with this invasive mollusk. One of the major concerns 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 attach themselves to boat motors, hulls and docks.


Photo Credit: Towne Post Network

Lionfish (*Pterois volitans*, *Pterois miles*)
Lionfish are native to the reefs and rocky crevices of the Indo-Pacific and were introduced into the Atlantic Ocean through the U.S. aquarium trade. These voracious predators, with virtually no natural enemies, are decimating native coral reef fish populations. Local removal efforts can significantly reduce lionfish densities (Invasive Lionfish Portal). And they are edible and delicious!

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. There are many ways that you can enjoy your fishing experience, while minimizing your impact. The following are a few recommendations to help protect the aquatic environment and its inhabitants:

Before going on a fishing trip, check your local rules for fishing license, size and bag limit regulations, and only keep fish that you intend to eat. Good catch and release practices will help fish have their best chance of survival.

Choose your tackle wisely. Barbless hooks are preferable 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.

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

Handle fish with care to minimize stress and harm. Use clean, wet hands when handling a fish as this protects their mucous and scales which helps prevents the fish from infection. Always hold a fish so it is well supported under the head, belly or tail. If you need to weigh it, use a cradle scale. Holding a fish by the eyes, lips or gills can cause irreparable damage. Minimize the length of time the fish is out of water to seconds, not minutes.

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 it will dissolve over time. If you take the fish out of the water, make sure it goes headfirst back into the water to help it breathe.

Protect the ecosystem.

- Unused bait, tackle or any other trash should be disposed of properly.
- Use fish-cleaning stations and discard fish waste in regular trash or save fish waste to use as chum or bait. Do not throw fish waste into swimming areas, marinas, anchorages, shellfish beds or other areas of high recreational use.
- Recycle monofilament (single strand, strong, flexible plastic) fishing line. It's not biodegradable and takes over 600 years to decompose (U.S. National Park Service). 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 if possible. Check to see if your local tackle shop runs a monofilament recycling program and if not, you can send it directly to Pure Fishing America (Berkley), 1900 18th Street, Spirit Lake, IA 51360-1041 for recycling.

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.

BOAT MAINTENANCE

ENGINE MAINTENANCE

Routine engine maintenance is important to optimize proper performance, fuel efficiency, clean exhaust and to protect water quality. 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 cracks, signs of damage and leaks.
- Change fuel filters (used to remove particles/debris) and fuel separators (used to remove moisture/water) regularly and have injectors inspected annually. Carry spare filters.

Oil

- Oil should be changed regularly - create a step-by-step plan to reduce any accidents.
- Temporarily disable your bilge pump, and after you change your oil, only turn the pump back on once you have checked for any contaminated oil or liquids.
- Use a closed system to transfer oil, decreasing your chance of a spill.
- When removing filters, place a strong bag around them to contain any drips.
- Keep an oil absorption pad below the engine to catch leaks and wipe up any spills.
- Proper disposal of oil is key to preventing runoff from land. When handled properly, oil and oil filters can be recycled. The EPA estimates that used oil from one oil change has the power to contaminate 1,000,000 gallons of water. Check with your marina to see if they offer collection of used oil for recycling, or use on Earth911.org to find your local recycling location.

Air

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

Water

- Check coolant levels before each trip. Antifreeze/coolant helps to transfer heat away from the engine, allowing it to operate at maximum efficiency. Most antifreeze (blue-green color) is highly toxic, poisoning an estimated 90,000 animals and 6,000 people in the U.S. each year (U.S. Humane Society and American Association of Poison Control Centers, respectively). Propylene glycol antifreeze (orange-pink color) is non-toxic, and has been proven to improve cooling by an estimated 60%. Antifreeze should be recycled and not poured down the drain or onto the ground.
- Check impellers, stopcocks, pipes and hoses for correct operation.
- Inspect overboard discharge for correct flow without any contaminants (oil/fuel).

Outboard Maintenance

- After each trip (fresh or saltwater), flush out your engine with freshwater. Most new outboards have a built-in flusher or you can use an "earmuff" flushing device.
- Be sure to environmentally friendly lubricant on moving parts.

Waste Disposal

- Use non-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 of.
- 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 – this makes them unacceptable for recycling.
- Ask your marina about disposal facilities for waste oils and associated byproducts.

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 for your boat: 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.

Wet Cell

$

+ Tolerates overcharging
- Requires maintenance - inspection and topped off with water
- High self-discharging rate
- Doesn't handle vibration well

Gel Cell

$$$

+ Maintenance free, spill- and leak-proof
+ Can handle extreme temperatures
- Sensitive to overcharging

AGM

$$

+ Maintenance free, spill- and leak-proof
+ Low self-discharging rate
+ Long lifespan
- Sensitive to overcharging

Lithium

$$$$

+ Lighter than lead-based batteries
+ Ideal batteries for electric engines
+ Long lifespan (some say they can outlast your boat's life!)
- Can overheat and cause a fire

The most versatile type for marine use is the AGM battery. If you don't use your vessel daily, AGM batteries will hold their charge better than wet and gel cell batteries. Long lifespan, low

self-discharge rate and outstanding performance make AGM excellent dual-purpose (deep cycle and engine starting) batteries for boaters.

Battery Tips

- Stay with one battery chemistry (wet cell, gel cell, AGM or lithium) for all of the batteries on your boat. 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.
- Regular maintenance is important as it extends battery life and saves money.
    - For wet cell batteries, frequently check the water levels and top-off with distilled water as needed. It is best to do this 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 like your basement.

If possible, use solar, wind or water power to trickle charge your batteries (see Renewable Energy Sources).

Lead Battery Recycling – The Success Story

More than 98% of all battery lead is recycled. Compared to 55% of aluminum soft drink and beer cans, 45% of newspapers, 26% of glass bottles and 26% of tires, lead-acid batteries top the list as the most highly recycled consumer product.

Batteries contain heavy metals such as mercury, lead, cadmium, and nickel, which will contaminate the environment if they are improperly disposed of. According to Battery Council International, more than 98% of battery lead can be recycled due to its closed loop cycle. 60% to 80% of the lead and plastic are reclaimed and used to produce new batteries. This keeps them out of landfills, waters and away from the marine environment

When recycling, always check your local legislation. You can 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. Conducting regular bilge inspections and quickly addressing any required maintenance will prevent oils from sneaking into the ocean.

Bilge maintenance tips:

- 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.

- Secure an oil-absorbent pad under your engine and an absorbent bilge sock next to (but not interfering with) your bilge pump.
- Keep oil and fuel-saturated absorbents away from heat or sources of ignition in well-ventilated areas.
- Discard used oil pads and bilge socks according to 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 is also highly toxic to marine life.

Recommended products:
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:

- Enviro-Bond 403 Bilge Sock
- CI Agent Marine Pillow
- West Marine Bilge Absorber Boom

Bioremediation:
The U.S. EPA defines bioremediation as a “treatment that uses naturally occurring organisms to break down hazardous substances into less toxic or non-toxic substances.” In short: oil-eating bacteria ingest the oil, turning it into a harmless substance. For these bacteria to work in your bilge, they need a small amount of water at 40°F minimum, and several weeks or months to work. This is good as a long-term oil treatment, but ineffective in short-term or accidental spill situations. NavalKleen Small Craft Formula is designed for use by recreational boaters.

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

The items listed below are in addition to engine, bilge and battery maintenance, and only cover points that might directly impact the environment. It’s not a comprehensive list for overall boat maintenance.

- 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 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.

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 and gather all the items you will need to winterize and store your boat.

Winterizing Checklist:

Engine(s)

- Fill fuel tanks and add stabilizer.
- 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 is 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 fresh environmentally friendly lubricant.
- Flush engine with freshwater using an "ear-muff' flushing device.
- Inspect and replace anodes.

Batteries

- If you take your batteries home:
    - Store them in a cool, dry place such as your basement.
    - Put them on a trickle marine charger.
- If you leave your batteries aboard:
    - Make sure battery cable connections are tight and free of corrosion.
    - 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 bilge pump operates properly.
- Pump out holding tank and add propylene glycol antifreeze to the head.
- Drain all systems that use water (water heater, freshwater system, shower sump, etc.) and replace with propylene glycol antifreeze as appropriate.
- Remove all food and beverages.
- Clean and vacuum to remove debris and food particles that may tempt winter critters.
- Open lockers, cupboards and drawers to air out.
- Take home cushions, life vests and portable electronics.

- Secure all ports and hatches.
- Turn off circuit breakers.

Store in the Water

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

Covering

- Protect your boat from snow, ice, water and debris when stored outside using:
  - Custom-made canvas or synthetic covers
    - Best at protecting your boat from the elements and is reusable.
    - Allows for air circulation – prevents mildew buildup.
  - Shrinkwrap
    - Effective at keeping rain and snow out, but susceptible to moisture buildup.
    - Professionals should shrinkwrap your boat as it is very easy to damage your boat and/or ignite the shrinkwrap.
    - Recycle your shrinkwrap!
      - 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.
  - If you use a different type of covering, make sure that it is water/snow proof, and that there is adequate air circulation.