BEST PRACTICES FOR ECO-FRIENDLY YACHTING

PRINCE ALBERT II OF MONACO FOUNDATION
Since its creation in 2006, The Prince Albert II of Monaco Foundation has been committed to the protection of the environment.

As a major event of the industry, the Monaco Yacht Show has an ability to set standards for environmental excellence. The Foundation has collaborated with the Monaco Yacht Show since 2010 with the establishment of the Wood Forever Pact, a program calling for the use of certified or sustainably harvested wood on yachts.

In 2016, the Foundation expanded the scope of this work with the launch of the Best Practices for Eco-Friendly Yachting. In this second volume of the guide, we continue to explore the ways in which all players can adjust their behaviors to address the externalities of yachting. This guide offers an outlook on industry innovations for constructing and refitting yachts in the future, as well as recommendations for limiting impact today.

Yacht owners, builders, and designers have an opportunity to be proactive in making strides for sustainability. At every step in a yacht’s life cycle, there are choices that builders, designers, owners, and captains must make. At every step, they have the option to pursue sustainable solutions. This industry could soon see widespread adoption of technologies such as entirely electric propulsion systems powered by renewable energy.

Prioritizing the environment and, more importantly, the future is all that it takes.

With the effects of climate change already evident, now more than ever it is essential to adopt new mindsets and behaviors to ensure the future of our planet. Without sacrificing the experience of luxury yachting, embracing these changes will importantly contribute to saving our environment.

HE Mr. Bernard Fautrier
Vice-President, Prince Albert II of Monaco Foundation
Sourcing Materials

Selecting materials for hull construction and decking is an opportunity to make choices that reflect a commitment to the environment. Along with its properties, availability, and cost, a material’s footprint should be criteria for selection. Ecological and carbon footprints measure a product’s impact on the natural environment and climate, respectively.

Hull Construction - The Problem with Synthetic Composite Materials

Composites are strong, lightweight, and easy to shape.

Problems

Composites are not able to be recycled.

Resins are so strongly bound to fibers that they cannot easily be broken down.

Using non-recyclable materials requires the manufacturing of new raw materials for future production.

Composites are composed of petroleum-derived epoxy resins that are bound to glass or plastic fibers. Manufacturing both the raw materials and the product are energy-intensive processes that produce greenhouse gas emissions.

Why it Matters

Used non-recyclable materials are often transported to landfills or incinerated. The transport, decomposition, or destruction of those materials are a source of carbon dioxide emissions that contribute to climate change.

Creating virgin materials that are based on non-renewable resources is not sustainable and will not be viable in the future.
Solutions

Natural Composites

After working with conventional composites to construct boats, Friedrich Deimann of Green Boats searched for alternatives and arrived on composites made with natural fibers. He then developed Wood 2.0: a material to structure hulls out of flax resin and recycled cork.

Natural composites offer the same qualities of strength and weight as glass-reinforced plastics, but its production uses five times less energy. The raw materials of Wood 2.0 come from renewable sources rather than petrochemical products, reducing dependence on oil. This product is 80% carbon neutral.

Constructed from natural fibers, the Greenbente 24 sailboat is evidence of this alternative material’s success. The aviation and automotive industries are looking to adopt this material. The super yacht industry could be the next to incorporate this innovation into future projects.

To learn more about composites made from natural fibers, please visit www.green-boats.de

Recyclable Materials

Materials like aluminum, steel, and wood can be recycled and reused as primary materials for future projects. Recycled aluminum only uses about 4% to 6% of the energy needed to make virgin aluminum.

What to Choose?

There are no perfect materials, so it is important to weigh the costs and benefits of each.

Recycled metals are strong, durable, and have a circular lifecycle. Composites are lightweight, but their strength still ensures a comfortable ride; however, the inability to recycle them and the emissions associated with their manufacturing is of major concern. Natural composites correct for these deficiencies as they can be made with recycled and/or renewable raw materials, while having similar weight qualities.
Decking: The Problem with Teak

Burmese teak has the reputation of being the best material for luxury yachts for its durability and aesthetics.

Problems

Teak has historically been overharvested and natural forests are being exhausted. Teak-exporting countries have implemented logging bans to protect forests, but demand for the wood remains high. Illegal logging operations that disregard responsible forest management practices are ubiquitous. Only if harvested sustainably is this resource renewable. Forest ecosystems and future teak extraction are at risk.

Why it Matters

Forests host a majority of the world’s species and provide a livelihood for local communities. Trees absorb carbon dioxide from the atmosphere and are valuable tools for regulating the climate.

Deforestation contributes to approximately 15% of global carbon emissions and leads to species extinction because of habitat loss. [WWF]. Biodiversity is valuable for pharmaceuticals, food security, and countless other applications.

Deviate from the Teak Trend

When looking into ecologically sound materials for a deck, the alternative of cork is currently being explored.

Natural cork is durable, comfortable, and heat-resistant. It is also easy to clean, rot-resistant, adaptable to shape, lighter than synthetics, and recyclable. The material thrives where there is sun and water, so it is fit for a yacht.

Fitted Seacork decking is currently about half the price of fitted Burmese teak decking, but that difference will become even more evident, as natural-growth teak is increasingly scarce. Cork is a credible natural alternative available on the market.

The environmental benefits of cork are unparalleled. One does not have to cut down a tree to harvest cork. The renewable raw material is the bark of Cork Oak trees, which are debarked every 9-12 years. Avoiding deforestation limits greenhouse gas emissions, as trees sequester carbon.

To learn more about natural cork decking, please visit www.liegemarine.com.
Most wood suppliers in the European Union do not have sufficient information about their wood supply chains and are in fact violating European Union Timber Regulations (EUTR), which prohibit placing illegally harvested timber or timber products on the EU market.

The most effective solution to the problem of illegal deforestation is to ensure that all wood is certified or sustainably harvested.

With the support of the Monaco Yacht Show, in 2010 the Prince Albert II of Monaco Foundation launched the Wood Forever Pact to promote wood sourced from sustainably managed forests in the yachting industry. Super yacht builders who become members can receive expertise on their wood supply chains, and wood suppliers, furniture makers, designers, and owners can join the pact to show their commitment to sustainably harvested wood.

WOLZ NAUTIC, WOOD FOREVER PACT PARTNER
An open discussion with André Hofmann, Head of Marketing & Sales Series Yachts.

Who are we?
Wolz Nautic is the worldwide market leader in the field of prefabricated teak- and yacht deck producing approx. 2000 decks per year.

Sustainable commitment
Since many years Wolz Nautic optimizes its production facilities in terms of innovative methods and raw material savings. We use high precision laser technology for making sure not to waste expensive raw material. In combination with the use of defined standard wood dimensions we can lower the loss and be more sustainable. The participation at development projects on teak alternatives or FSC-certified production methods are our aims for the next months.

Why join the WFP?
Wolz Nautic wants to be part of the WFP to show that we are supporting projects or organizations who do care about optimizing the market situation in the field of teakwood, illegal wood cutting, improving working conditions in the origin countries such as Myanmar etc.

Acting in Myanmar
We have been discussing the situation in Myanmar for years with our timber suppliers, and have made on-site visits on several occasions to get an impression of the situation for ourselves. We also discuss the correct action with government departments and inspection agencies. Our suppliers must provide us with evidence at regular intervals on the legality of the supplied timber. If our suppliers have and continue to act within the necessary and possible framework, we then conclude longer-term call-off contracts for the purposes of, on the one hand, ensuring the procurement and thus the supply of the timber we need and, on the other, to give the respective suppliers planning security so that they have sufficient lead time and can act with the required diligence.

European suppliers and legality
Wolz Nautic buys its teak wood from the main wood dealers in Germany and Europe. We use teak of Myanmar. The teak dealers must guarantee the legal origin of the teak due to the fact that they are the first one who are bringing the teak on the European market. We have a broad supplier basis which is very important for us.

A lot has changed for the better in recent years in Myanmar. For example, the fact that it will now be possible to obtain all necessary documents; however, the actual procurement of the timber will be considerably more cost-intensive. In addition, the harvesting of timber has been massively reduced and all timber exports is subjected to an extra tax of 10 percent as from 1 April 2017. That’s the current challenge.

Apart from that especially concerning FSC-certified teak we are looking for possibilities to get this material from sustainable forestry sources in Africa or South-/Central America. This process is started.

Use of certified wood
The use of certified wood is possible but it depends on the requirements of the shipyards. Especially if a certified wood will be specified. Currently we are working on several projects where we will use FSC-certified wood as well as normal teak wood for other projects.

To go one step ahead of our competitors Wolz Nautic started the re-certification process for FSC-certified teak deck production. The audit process was successful and since August 2017 Wolz Nautic holds the FSC-certificate for its production. For more information: www.wolznautic.de/de/
Fuel Reduction

Super yachts are conventionally powered with fossil fuels...

... which are damaging to the environment, as extraction degrades natural ecosystems, combustion emits greenhouse gases that contribute to climate change, and oil spills and bilge water pollute marine ecosystems with toxins and carcinogens that harm both animals and humans.

Limiting fuel consumption can benefit yacht owners. Fuel is expensive, so reducing consumption saves costs. Advanced engine systems and minimal fuel use can also make a journey quieter and more relaxing.

Electric Engines

Conventional combustion engine systems are increasingly obsolete.

Alternatives include diesel-electric propulsion systems that have diesel-run generators that provide electricity for the services on-board and for electric motors. There are also hybrid-electric propulsions that have electric motors in addition to traditional combustion engines. It can use either of the technologies, depending on the mode of operation.

In the future, renewable energy technologies rather than diesel generators will provide the electricity for engines.
The winner of last year’s Monaco Yacht Show RINA award, the WIDER 150 super yacht, is an example of luxury and sustainability in harmony. A testament to the yacht’s environmental excellence, the WIDER 150 was the first vessel to receive a perfect score of 100/100 from RINA.

The WIDER 150 is diesel-electric with an Azimuthal pod propulsion system coupled with a 544 kWh battery bank. The yacht can cruise for up to 30 nautical miles using only electrical power stored in battery packs in Zero Emissions mode. Alternatively, battery power is capable of running all of the services for a full night while at anchor in total silence and with no vibration.

Its full-displacement hull and superstructure are made from aluminum, a recyclable material. Full displacement hulls are the most efficient designs, as they use less fuel than planing hulls that climb above the water and have low maximum speeds.

The power management system, which efficiently manages the yacht’s four variable speed generators and battery banks, enables fuel consumption of just 84 liters per hour at 10 knots—some 20% more efficient than a comparably sized yacht with traditional propulsion. In addition to operational efficiencies, the diesel-electric system allows for a flexibility of design layouts, so there is ample room for pleasure on board.
Renewable Energy as Fuel

In addition to the evolution of engines, an emerging trend in the yachting industry is energy autonomy.

There are increasing numbers of renewable energy technologies available that can power yachts. Solar, wind, hydropower, and hydrogen are able to supply power to electric engines.

The Energy Observer is a research endeavor and a model for the future of super yachts. This vessel has complete energy autonomy.

It uses electrolysis to extract hydrogen from water that will be compressed and used in a fuel cell to generate electricity. It also has solar panels and wind turbines on board. The combination of these renewable energy technologies charge batteries that power the electric propulsion engine.

The Energy Observer has embarked on its journey to sail around the world for six years to communicate how it is in fact possible to navigate the seas without greenhouse gas emissions and transition to a clean energy economy.
Biofuels

Until this vision becomes mainstream, there are less-polluting alternatives to diesel currently available.

GoodFuels Marine is a market leader and supplier for sustainable biofuel. Unlike other biofuels that inadvertently increase pressures on the environment when growing biomass, GoodFuels Marine uses waste streams as its raw materials. It makes sure that its waste streams are not associated with food production or stimulate deforestation to truly commit to sustainability.

The product is a “drop-in” biofuel—one that does not require any alterations to the existing engine or infrastructure. Biofuels provide a solution for those who cannot change their engine into an electric propulsion system but still want to limit their reliance on fossil and reduce their emissions footprint.

Emissions reductions are significant: this biofuel is sulfur-free, and it reduces carbon emissions by 80-90 percent and lowers the local emissions of nitrous oxide and particulate matter. The most popular product is a 30% blend, achieving a carbon reduction of 25%, while still remaining affordable.

Ports and vessel owners can sign up for more information to order this fuel. To learn more, please visit http://goodfuels.com/marine

Foul Release Paint

Antifouling prevents the buildup of algae, crustaceans, and slime that accumulate on a yacht’s hull. The additional weight and increased drag from fouling requires more fuel to move the yacht. Fouled vessels can use up to 40% more fuel and thereby emit 40% more greenhouse gases, so adopting antifouling measures will improve efficiency (IMO).

Traditional anti-fouling coatings are formulated with copper biocides that are highly toxic and potentially lethal to marine species. A biocide-free alternative is foul release coating. Rather than poisoning the creatures that come in contact with the hull, these paints are silicon- or fluoropolymer-based and form a smooth surface on the hull that is so slick that organisms have trouble attaching to it.

Many marine paint companies offer foul-release coatings without biocides, including:

- Akzonobel: Intersleek Line
- PPG Industries: SIGMAGLIDE 1290
- Hempel: HEMPASIL X3
- Jotun: SeaLion Repulse
- Chugoku Marine Paints: Bioclean Eco
Marine Debris: Plastic

“By 2050, the quantity of plastics in the ocean will outweigh fish (IMO).
At least 100,000 marine animals die each year from ingesting plastic or suffocation (Tara Expeditions).”

Plastic is the most prevalent form of marine debris. Most plastic breaks down into micro plastics, which are not visible to the human eye but are nonetheless capable of corrupting marine habitats.

Why does it matter?

Sea turtles, birds, and marine mammals can become entangled in large pieces of plastic. Micro plastic particles are so small that marine beings can ingest them. The toxins in micro plastics interfere with the biological processes of marine species and can ultimately harm humans eating seafood. Marine debris also undermines recreation and tourism, which rely on healthy marine habitats and serve as the livelihood for many coastal communities.

Debris can damage a yacht’s hull or interfere with its engine and propellers.

Solutions

MARPOL Annex V mandates a complete ban on the disposal of plastic in the sea (IMO).

Annex V ensures that ports and marinas are equipped with waste facilities to prevent dumping debris overboard (IMO). Yachts must have sufficient waste holding systems that can properly separate recyclable waste, non-recyclable waste, and food waste.

The Prince Albert II of Monaco Foundation, along with Surfrider Foundation Europe, Tara Expeditions, the Mava Foundation, and IUCN, joined together to form Beyond Plastic Med (BeMed) in March 2015.

The Beyond Plastic Med Task Force supports innovative local initiatives in the Mediterranean and influences regulatory decisions aimed at reducing coastal plastic pollution and educating the general public about the severity of this problem.

Following its first call for micro-initiatives in June 2016, BeMed has selected 11 projects in 8 Mediterranean countries to financially support. It is possible for all actors of the yachting industry who are interested in the fight against plastic pollution to join BeMed’s network.

To learn more about BeMed, please visit www.beyondplasticmed.org
In addition to solid waste, oceans are polluted with toxic liquids. Untreated wastewater that ends up in the sea will harm marine habitats and can contaminate drinking water sources.

Grey water refers to the water that flows from showers, sinks, dishwashers, and washing machines. Grey water contains fats, soaps, chemicals from household products, and phosphates. Phosphates promote excessive algae growth in bodies of water. Algae absorb oxygen, leaving other aquatic species vulnerable to suffocation. This phenomenon, known as hypoxia, has lead to numerous fish kills and ecosystem collapses. Because marine species cannot survive in these low-oxygen zones, they are appropriately named dead-zones.

Sewage from urinals and toilets is known as black water. Black water is dangerous to marine ecosystems because it contains nutrients, which can spur algal growth and hypoxia, and bacteria that can expose both animals and humans to illness, either through direct contact with contaminated water or through seafood consumption.

Bilge water accumulates in the lowest part of the vessel and is comprised of cleaning agents, lubricating oils, fuel, and other leaked fluids. This water contains carcinogens that are dangerous to humans and marine animals. Bilge water is oily and viscous, so it is capable of smothering marine species and restricting their biological functions, leading to death.

Solutions

MARPOL Annex IV prohibits the discharge of sewage into the sea, except when treated with an approved system, or at a distance of at least 3 nautical miles from the nearest land for disinfected sewage, and at a distance of 12 nautical miles from the nearest land for not disinfected sewage [IMO].

Most ports are equipped with pumping stations where yachts can empty contaminated water from their holding tanks. It is encouraged that all yachts take advantage of these pump-out stations and not illegally dump toxic waters into the sea.

Furthermore, one should use only non-toxic and biodegradable soaps and cleaning products on board. Especially beneficial is the use of products with neutral pH’s and without phosphates.

Grey water and black water can often be treated and recycled for other uses, like water in toilets. Yacht constructors should install systems that perform this technology.

To limit bilge water, one should be careful when loading fuel into an engine before departing.
Food Waste

Food waste, although it does not pose as much of a direct threat to the health of marine ecosystems, is a major contributor to climate change.

If food waste were a country, it’d be the nation with the third highest greenhouse gas emissions after the United States and China. Food waste represents 8% of global greenhouse gas emissions (WRI).

An extremely inefficient system, food waste occurs at every stage of the supply chain: on the farm, in processing plants, in transit, in markets and restaurants, and in the hands of consumers on land and at sea.

Solutions

Annex V of MARPOL provides special provisions for dumping excess food waste overboard. Ground or comminuted food may only be discharged at a distance of at least 3 nautical miles from the nearest shore outside special areas, or at least 12 nautical miles away within special areas. It is prohibited to dump non-comminuted or ground food waste overboard within special areas. Outside special areas, non-comminuted or ground waste may only be discharged at a distance of at least 12 nautical miles from the shore (IMO).

Food waste reduction is imperative for super yachts. Some companies even offer waste compression technologies specifically for food waste. Besides regulations, super yacht owners have an opportunity to take a stand against food waste, by being conscientious of what they eat on board and how they dispose of it.

Ultimately, most wasted food ends up in landfills that emit methane, a potent greenhouse gas. Composting is a solution that problem. Future yachts could look into installing compost systems.
Each year Posidonia oceanica loses 1.5% of its surface (MEDPAN).

Posidonia oceanica is an endemic seagrass in the Mediterranean. It is legally protected, but there are no regulations ensuring its conservation. An essential ecosystem, it regulates the clarity of the water, prevents erosion, serves as the habitat and food source for marine species, produces oxygen and absorbs carbon. It is vital to continue the protection of this species to preserve biodiversity and sequester carbon to slow acidification.

To learn more about Posidonia oceanica’s role as a lynchpin of marine ecosystems, read the RAMOGE report at www.ramoge.org/Documents/documents%20ramoge/Posidonia_ramoge.pdf

When ships anchor, they can uproot and destroy Posidonia oceanica. A fragile seagrass with an important function, it must be protected.

Solutions

To preserve this sea grass, yacht captains should look to anchor only in sandy areas. The app Donia can easily provide information about the surface of the seabed below the yacht to ensure anchorage only in appropriate places.

It is also imperative to clean anchors after use. If anchors are not clean as the yachts are cruising, they can introduce bacteria and invasive species, like Caulerpa taxifolia, to Posidonia habitats of the next anchorage and can disrupt the natural ecology of the community.

To learn more about the Bay of Pampelonne’s plans, visit www.observatoire-marin.com/mouillagepampelonneuk.htm
After about 30-50 years of use and refits, a yacht will near the end of its life. At this point, owners can sink their yacht or send their yacht to be dismantled.

Abandoned or sunken yachts present a host of serious problems. They damage habitats, leak oil and any hazardous materials that were on board into the ocean, and could obstruct navigation. On top of all this, sinking a yacht is disrespectful of the effort that was put into the construction of the yacht and the raw materials that built it.

Deconstruction is a much better option for a yacht at the end of its life; however it is important that the process is respectful of the environment. Ecologically minded dismantling ensures that hazardous liquids and batteries are properly disposed and recyclable materials are recovered and able to be reused.

Some technologies that break down composites into reusable forms are available but not currently on an industrial scale. However, there is extensive research into recycling possibilities for end-of-life yachts. The system will continue to develop overtime.

Even for non-recyclable materials, there are some available practices that advanced waste management systems use to avoid landfills. A solution for the time being, solid recovered fuels (SRFs) are created from waste materials that cannot be recycled, like composites, and can contribute to cement production. The manufacturing of this fuel is still energy-intensive, so it is only an intermediate solution, but it reduces reliance on petroleum and it eliminates landfill waste.

Solutions

It is best to dismantle your yacht in a country whose regulations include environmental, health, and safety protections and whose workers are familiar with best practices for ecological deconstruction. Countries with advanced recycling networks for pleasure boats that take these principals into account are France, Sweden, Finland, and Japan. Other countries have reliable policies, such as the United States, Canada, Australia, New Zealand, and other nations within the EU.

APER (Association pour la Plaisance Eco-Responsable) is a network of waste-management professionals focusing on boat deconstruction throughout France. To learn more about yacht dismantling in France, visit www.aperasso.fr.

To learn more about boat dismantling systems that aim to improve health, safety, and environmental standards across Europe, visit www.boatdigest.eu.
**Fuel Reduction:**
- Cruise at slower speeds to ensure reduced fuel consumption.
- Do not idle when there is no berth or mooring buoy available.
- Do what you would do on land at sea—invest in LED lights and other energy efficient appliances to reduce fuel consumption.

**Marine Debris:**
- Limit plastic products on board and be conscientious of the amount of food waste that you produce. Avoid dumping waste into the sea.
- Check that all equipment is functional before departing to avoid oil leaks.
- Only use non-toxic, biodegradable, phosphate-free cleaning products on board. Use biocide-free anti-fouling paint.
- Do not dump wastewater into the sea. Pump it out of your vessel at port so it can be treated.

**Anchoring:**
- Only anchor on sand and in authorized areas. Be sure that you do not anchor where there is sea grass. You can use the app Donia to check the type of seabed beneath your vessel.
- Use mooring buoys rather than anchors whenever possible.
- Make sure that anchors are clean as soon as hauled up on deck to prevent the spread of invasive species when dropping them in another spot.

**Refits and Deconstruction:**
- Use refits as an opportunity to update your yacht with the latest sustainable technologies.
- When your yacht is nearing the end of its life, deconstruct it in a country where there are regulations that are mindful of environmental and social costs.