Finding a way through heavy ice in the Central Arctic Ocean. Photo by Conor McDonnell.

Bagheera

An Expedition Vessel Comes into her Own

Hull construction, April 2005: the deck, bottom plates, and topsides are on.

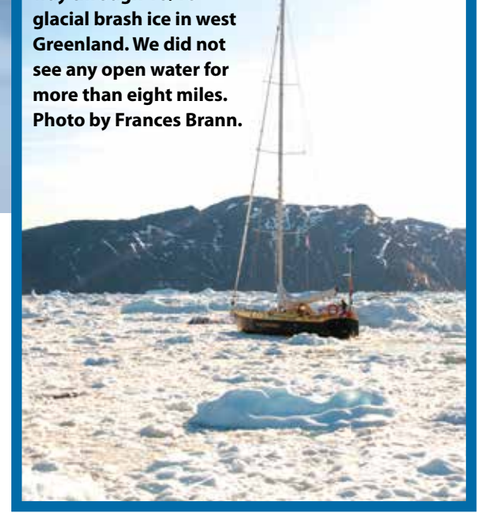
by Erik de Jong, Bras d'Or Station

LAST SPRING, *BAGHEERA* CELEBRATED HER tenth birthday. Over the past decade, she has carried us over 75,000 miles in Arctic and subarctic waters. This is the story of how *Bagheera* came to be and a reflection on her design.

I was born in the Netherlands and raised by parents who love to sail. When I was ten, we started sailing in the high latitudes during family vacations. It was during these voyages that I started thinking about a life at sea, exploring the most remote corners of the world.

When I was 12, my parents decided to build a new boat, and I went to the naval architect with my father, a professional boatbuilder, to finalize the purchase of the design. I was shocked by the price, calculating that it would take over 200 years of saving my weekly allowance to afford a design of my own. In that moment, I decided to become a yacht designer so I could save on design costs. Luckily, my 12-year-old self did not know about building or maintenance costs. This blissful lack of knowledge helped keep the dream alive while I read through all the books I could find on boat building and design.

By the time I was 16, I had designed *Bagheera,* a 52-foot expedition sailing vessel. It wasn't until a year later that I could attend university and start a professional education as a naval architect. The design got tweaked in between my university lectures, and by the end of the three-and-a-half-year program, the *Bagheera* design became my graduation project. Around this time, I finally found the courage to show my father the drawings and ask for his professional opinion. He studied the drawings for a long time without saying a word, and after what felt like an eternity, he asked one simple question: When will we start building? I stuttered a bit about finances, being a student, not having a well-paying job, and all kinds of other excuses, as I did not really intend to start building right away. My father calculated that buying the steel would not cost very much and reminded me that I wouldn't have to buy it all at once. Two months later, a large truckload of steel was delivered to a small building lot near my parents' home. There was now no question as to how I would be spending my evenings and weekends.



Bagheera **making her way through 10/10 glacial brash ice in west Greenland. We did not see any open water for more than eight miles. Photo by Frances Brann.**

It took my father and me four-and-a-half years to build a technically finished boat (with no interior) and get it ready to sail. All the work was done by hand in the open air, and the only piece of heavy equipment we had available was a forklift.

Bagheera's main design features were based on my 20 years of sailing experience with my family, combined with ocean-racing experience I gained while working as a part-time sailmaker during my university years and deliveries of a wide variety of boats. My design brief was that she be simple, low-cost, low-maintenance, fast, ice-reinforced, well-insulated, comfortable, easy to handle singlehanded, and able to survive autonomously for a year; have enough power to push through 5/10 ice; and be capable of wintering over in the Arctic without damage.

After launching in the early spring, we waited for a strong low to move in over the North Sea to give the boat a good practical test. We sailed the first half of the voyage downwind and the second half upwind to Norway, and it only took a day and a half to cover the 330 miles. After spending one night in Egersund, we sailed back to the Netherlands in a similar time frame with even stronger winds and more confused seas. This test voyage resulted in a list of repairs and improvements before we could cross the North Atlantic to Nova Scotia, where I had accepted a job as a naval architect. I had only a couple of months to make it there. *Bagheera* was to be my home. Among the tasks to be done was fixing a slow oil leak in the gearbox, raising the

Erik's father, Willem, rebuilding the engine before it is installed in *Bagheera*. Photo by Henny de Jong.

steering compass higher above the deck to have less interference with the boat's steel hull, add some handrails, make small alterations to the reefing system of the mainsail, recalibrate the autopilot, remake the jack lines, add a couple of dead eyes in the cockpit for lifeline attachment, add nonskid to some of the interior parts, and get a Navtex to receive some ice information for the Grand Banks of Newfoundland.

From the Netherlands, we sailed to the Orkney Islands, where we stopped briefly before continuing nonstop to Halifax. In theory, we wanted to sail far enough north that the lows would pass to our south, providing easterly winds. However, that spring, the lows were pushed much farther north, and we ended up sailing 19 days upwind, often in gale-force winds. It was *Bagheera*'s baptism by fire, and she withstood it all with flying colors.

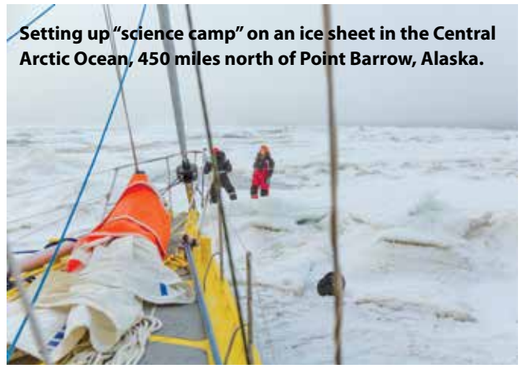
That winter, I finished the interior, and *Bagheera* began her career as a charter boat in the Arctic. Over the years, we have facilitated research, film, photography, and mountaineering projects, as well as taken on adventurers, tourists, and mile-building offshore sailors who wish to visit remote areas.

During our voyages, *Bagheera* has proven that she can withstand anything that nature (and human stupidity) can throw at her. There has never been a moment that we felt unsafe or weren't sure how she was going to behave. On one occasion, we had to push her through 8/10 ice to escape an ice-locked anchorage and negotiate 35 miles of heavy sea ice. The engine had to work overtime, and we needed to maneuver in tight corners, but her rudder, propulsion train, and ice reinforcement proved to be up to the job, and we made it out without a scratch.

At other times, we have ridden out hurricane-force winds, both at sea and at anchor. While sailing from Newfoundland to Greenland in the early spring, we got a beating from a westerly storm. Sailing along at nine knots on a beam reach, *Bagheera* was negotiating the waves as if they were not even there until a wave significantly higher and steeper than any others we had encountered came out of nowhere. Before I could even take any form of action, the mast was under water. Within a matter of seconds, the boat was upright again, shaking the water off her decks and accelerating back to her favorite speed as if nothing had ever happened. Except for a big mess down below from a shattered container of pasta and bottle of olive oil, there was absolutely no damage.

***Bagheera* on her way to the paint shed, with only one coat of primer on.**

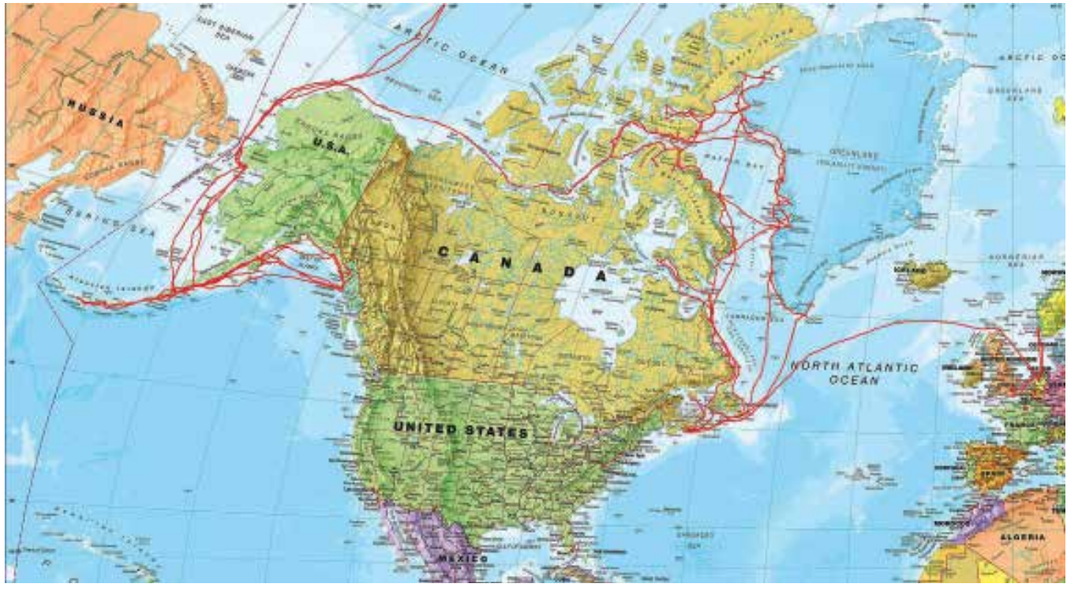
Eighty-plus knot wind gusts, howling though Kodiak harbor.



Setting up "science camp" on an ice sheet in the Central Arctic Ocean, 450 miles north of Point Barrow, Alaska.

Bagheera has hit uncharted rocks at full speed, and due to an autopilot error, she hit an iceberg that folded our 110-pound anchor around the bow like a piece of origami—but again, in neither case was there any form of damage to the boat. On another occasion, while in a side arm of Disko Bay in Greenland, an area that has about five feet of tidal difference, we decided to anchor in 17 feet of water with the tide still rising. At 3 a.m., we woke up to a wineglass shattering on the galley counter and realized that *Bagheera* was heeled over 20 degrees. Apparently, the tidal difference in the southeast corner of Disko Bay is more like 12 feet, and *Bagheera* was lying in four feet of water. Needless to say, the stout structure of the keel didn't even register the incident.

One of my design requirements was that the boat should sail well, especially in light air and upwind. Most expedition-style boats are lacking on these two fronts. *Bagheera* could not be like that, as light air occurs frequently in the north, and one sails upwind about half the time in this area. Light wind capabilities are mostly determined by the ratio between wetted surface and sail area. We chose the smallest possible wetted surface that we could construct, and increased the rig size by 30 percent of what is typical on boats of this style and size. This has resulted in a reduced need for engine hours when sailing in the semi-permanent high-pressure zones in the Arctic. In order to sail upwind, we opted for a ten-foot-deep fixed keel with almost all the ballast in the lower third. One of the advantages of such a deep keel is that you can get the same righting moment with less ballast weight, and therefore can reduce the total weight of the boat. This was especially important since *Bagheera* is built of steel and is heavily ice-reinforced. By going deep with the keel, we could reduce the ballast ratio to only 25 percent and still have a stiff boat. In addition, the diesel tank is mostly in the keel fin, the batteries are right on top of the keel, the engine is just behind it, and the anchor chain (weighing a little over 900 pounds) is at the base of the mast, about three feet under the waterline. All this adds to the stability of the boat and makes her sail very upright. The tall rig and deep keel make her point high and sail upwind like no other cruising boat we've ever seen. She makes good headway even when the wind blows 50 knots on the nose in the open sea.



While *Bagheera*'s keel has never been a problem when it comes to water depth, ten feet is about the maximum practical depth for handling a boat on dry land in a boatyard, and we have occasionally come across yards that can't lift her high enough. Still, the performance advantage outweighs any haul-out inconvenience.

The accommodations are very simple. The boat is divided into six watertight compartments by various bulkheads, which also make up the interior. These bulkheads are well-insulated to create both noise and temperature barriers. When we decide to spend a winter in the high Arctic, we can close parts of the boat off with the watertight doors, which leaves a small, very well-insulated space that is efficient to heat.

Steel boats have a bad reputation for being rust buckets and maintenance nightmares. But in our experience, they will be almost maintenance-free for decades, assuming that an appropriate paint system is selected and properly applied. *Bagheera* is painted with a two-part epoxy paint, originally developed for large commercial cargo ships. The steel that was procured for building the boat was pre-sandblasted and coated with a welding primer. When it was time to paint, we sandblasted half the inside of the boat on the first day, cleaned up all the sand and dust, and painted that part with an etch primer. The next day, we did the other half of the inside, and on the third day, we completed the outside of the boat. The interior received four coats of primer and one coat of finish paint. On top of that, we applied a gas-tight, fire-retardant, two-part polyurethane insulation foam that varies from three to six inches thick. We coated the outside with 12 thick layers of primer and two layers of topcoat in the final color. When selecting the colors, we wanted to use something that stood out, was memorable, and had added value. After reading various articles on visibility of yachts at sea, we concluded that the topsides of the hull should be a dark color, and the deck an unusually bright color. Studies have shown that dark-colored hulls are more visible from the bridge of a ship in bad weather, while the bright, contrasting color shows better from the air in case of a SAR mission. We opted for black and yellow, as those two colors complement each other and are easy to get used to. An unintentional but positive side effect is that yellow is an absolutely brilliant color for contrast with nature and wildlife photography. We get a lot of professional and semi-professional photographers onboard, who all seem to love the contrast between nature and the yellow deck. It also results in *Bagheera* being very recognizable.

We are very happy with the rig. The mast is made by Selden and is superb in quality and performance. It features an internal rail that is part of the extrusion, which allows the mainsail cars to be inside the mast. In addition to avoiding an expensive, high-maintenance external rail, this also saves weight aloft. I made our Hydranet Radial sails myself—a woven blend of polyester and Dyneema that is extremely durable, flexible, and lightweight. After 75,000 miles, we are still using the original sails, which still have practically the same shape that they had when they were new.

Bagheera's electronics are extremely simple. No instrument talks to another, which basically means that there is no network onboard. A backup battery bank for emergency situations will independently feed the main communications equipment as well as the important navigational equipment. All the electronics are by Furuno, and none have ever failed us. Even when we endured a direct lightning strike, most of the instruments continued working. For long-distance communication, we use Iridium, with a main-unit pilot that was installed in 2017. It gives us 128 kilobits-per-second internet aboard and never seems to drop a single bit. Disappointingly, our two autopilots are not trouble-free. The first, a Furuno NavPilot, originally drove an electric motor made by Jefa. However, the clutches kept failing, resulting in a pilot that can no longer engage. We added a hydraulic ram to the Furuno-driven quadrant and added a Simrad autopilot, which drives a completely new electric motor, also by Jefa. Even though it is a very expensive unit, it has already failed four times, each time for a different reason. The problem has always been resolved under warranty, but it is an absolute pain in the neck. The electrical motor is another story—it too keeps failing, and the clutches are flimsy at best. After eight years of struggling with the manufacturer and very high bills, we decided to give up on them and rely on hydraulics instead. The Furuno itself has never missed a beat so far, which only confirms my faith in this professional, ocean-going brand.

The engine is a story unto its own. For budgetary reasons, we installed a 30-year-old, rebuilt Ford Lehman. A heavy, medium-rpm, six-cylinder diesel, it is extremely simple and requires no special knowledge or tools to keep it running. It has only one big design flaw that we found the hard way, twice. The fuel return lines, which also cool the injectors, are under the rocker cover, meaning that any leak in the 36 connections in the return line remain unnoticed until the engine stops—which happens because the engine oil becomes diluted by diesel and loses its lubricating capabilities. The result is a seized engine that cannot be repaired and must instead be completely rebuilt, and the crankshaft machined. The first time this happened, in 2014, we were in Greenland. I managed to buy half an engine block in good condition and had it flown to Greenland, where, after a few days of long intensive work, we managed to get one working engine out of two partial engines.

Encountering a gale in the Beaufort Sea, September 2015. Photo by Frances Brann.

The next failure, for the same reason, occurred while we were on our way to the Arctic. We were only 30 miles away from home when the engine seized. This time, the Ford Lehman was replaced by a modern common-rail Yanmar—half the weight, half the size, less noise, and substantial fuel savings, but above all, practically maintenance-free compared to the Ford. The downside was that it cost a lot of money, and it took another 10 days to completely rebuild the engine room while we were under a lot of pressure to make it north for the Arctic research project we had committed to.

Bagheera still has many years ahead of her. For our style of travel, the knowledge that we had at the time of building, and the available budget, *Bagheera* has been perfect, and she is low-maintenance. After having sailed with *Bagheera* for over ten years, there is very little that we would do differently. ⚓

For more information about Bagheera, *see bagheerasailing.com*

ABOUT THE AUTHOR

Erik de Jong and his wife, Krystina Scheller, started blue water cruising as infants onboard their parents' boats. Being drawn to Arctic waters, they met each other in Greenland and have sailed together ever since, either on the same boat or on separate boats in company with each other. In the winter, they live at their house in Sitka and in the summer, they sail in the Arctic or their home waters in Alaska.