Manicouagan: asteroid circuit by kayak

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Photographs: `https://webspace.science.uu.nl/~rutte101/travel-albums/manicouagan/album.html`
Website: `https://webspace.science.uu.nl/~rutte101/Kayak_Manicouagan.html`

During August 2006 my wife Rietje and I fulfilled an old dream: to kayak the annular Manicouagan impact crater lake in Quebec. We paddled the full 200-km circuit, a pure wilderness voyage in magnificent scenery.

Manicouagan Reservoir: the lake is the combined product of one of the largest known impacts on Earth, the subsequent ice ages, and a gigantic retention dam. It is shaped as a 10 km wide annulus around a nearly circular island of 56 km diameter. Both the lake and the island measure 2000 km^2. Together, they appear as the beautiful "Eye of Quebec" on photographs from space. It is one of the most striking structures on the face of the Earth and the most obvious impact scar.

Impact: a 5-km bolide (asteroid or a yet larger comet) hit this area, then part of Panagaea, 214 million years ago. It caused a fireball as far as present-day New York, a melting pot boiling the local bedrock over 50 km extent and 9 km depth, and a crater wall of about 100 km diameter. This event occurred during the Mesozoical Triassic, a warm era in which therapsids including pre-mammals throve, halfway between the previous and present cold episodes. Surprisingly, the massive extinction at the Triassic-Jurassic transition, starting the age of the dinosaurs and as bad as the K-T extinction ending it, is dated 13 My after the impact (the even worse Permian-Triassic

"great dying" event took place 37 My before it). The verdict seems to be that the Manicouagan impact went without marked mass extinction. I speculate that the hard Triassic rock and underlying pre-Cambrian Canadian shield absorbed the shock as waves without pulverizing and liftoff, while the soft Yucatan limestone went up into the atmosphere causing a global re-entry firestorm and global winter. The beautiful annular form of the Manicougan reservoir indeed suggests wave spreading.

Ice ages: The recent glaciations of the present cold episode scraped off a kilometer of overlying Canada including the outer crater wall, but not the molten and re-solidified central area. They also scooped up and excavated a wide ring of impact-fractured bedrock around the harder central melt, producing a dug-out moat around what is now a lonesome Triassic hump on the Precambrian Canadian shield, the most beautiful impactite[1] mountain on Earth. Its tops, including Mont de Babel and Maskelynite Peak, represent uplifted 1000 million years old Grenville target rock that was shocked but melted only partially.

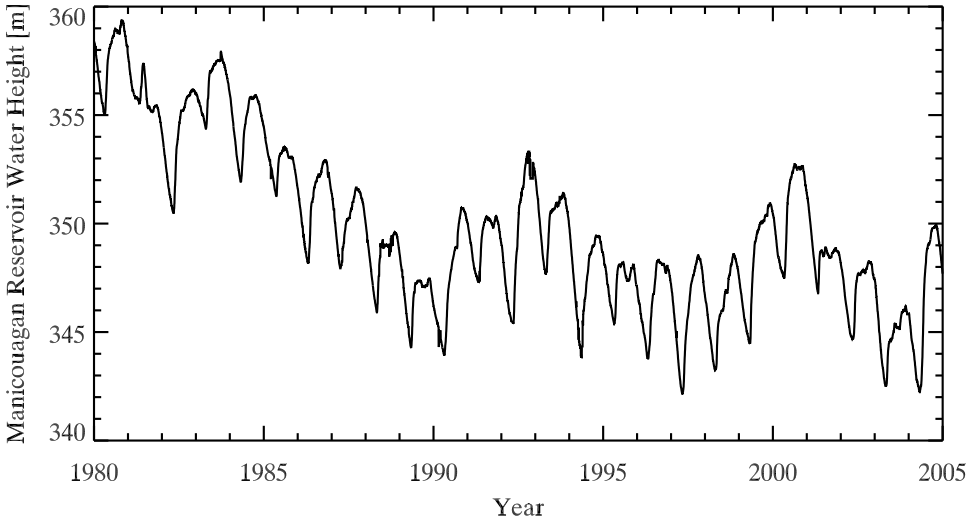
Retention dam: Manic-5 (or "Daniel-Johnson" after the Quebec Premier who died partying at its completion) is located about 60 km south of the excavated annulus, 214 m high and 1.3 km long atop a canyon of the former Manicouagan river. During the 1960s this was the largest construction site in North America, taking 13000 workers (also making 400 babies) and 2.2 million m^3 concrete to inundate an area of 2000 km^2 including the annular moat, as large as the impact-melted hump which emerged as the central island ("Isle René Levasseur") to become the largest man-made island on Earth. The average lake depth is 85 m. The maximum depth of 350 m almost reaches sea level, showing that the moat wasn't carved out by rivers; there were already deep sickle-shaped lakes East and West of the melt mountain before the complete annulus filled up. The dam delivers 2500 megawatt through two power stations, the newer one underground. The dam is not a single thick curved wall but consists of 13 thinner curved vaults supported by 14 large buttresses, like the walls of cathedrals. After its completion worrisome cracks appeared; the vault backsides are therefore now cooled to the temperature of the under-water frontside except for the huge central vault which is sufficiently thick (27 m at its base, only 7 m for the others; the dam crest is 6 m wide). For comparison: the Three Gorges Dam in the Yangtze, fully completed by the end of 2009, is a kilometer longer, only half as high, 115 m thick at its base, can yield nine times more megaWatts, and drowned the houses of well over a million people. I suppose nobody was displaced by the Manic-5 inundation.

Kayaking the moat: I noted the ring many years ago in our son's school atlas (it didn't yet exist in my own school time; now, it is even visible in the Google Maps opening screen for all of North America). Ever since I planned to kayak the circuit. My wife Rietje and I did that together in August 2006. About 200 km over a lake that looks more like a sea. And behaves like a sea. On average the lake is 10 km wide, but due to its annular shape there are always two 50-km long open reaches for wind and deep-water waves to build up so that tall breaking waves develop quickly. They refract around the central island until they meet. The wind and waves also refract around and reflect off high capes and islands to produce substantial wind veer and clapotis (wild waves). Sea kayaks suit better than canoes, and it is better to hug the windward shore for surf-free landing. Frequent rough weather makes the reservoir a larger challenge than kayaking the Baltic or Mediterranean – except that almost everywhere landing and camping are easy and beautiful, that the water is fresh, pure, and warm enough for swimming (in August in shallow bays), that there are no tides or currents, and that one doesn't meet anybody else whatsoever. A pure wilderness trip in outstanding scenery, perhaps the easiest such expedition in the wilds of East Canada. A lonely wilderness: on the second day we set our watches back to Halifax time to suit our preferences re sunrise and sunset – we wouldn't meet anybody else for three weeks. But a cool wilderness: although the sun climbs just as high as in Holland, the weather is often much cooler, the vegetation is subarctic ("boreal forest", as in Lapland), and the lake starts freezing already in September.

[1] There are five types of rock on this planet: igneous, sedimentary, metamorphic, impactite, and trinitite. Rietje and I trod them all.

Impact appreciation: it is hard to grasp while paddling the enormous circuit that one circles a single impact-from-space structure. Of course that is why we did it; it gives a dramatic extra dimension to the already marvelous scenery (perhaps especially for an astronomer). However, paddling day-in day-out through this wide wilderness expanse does not give a crater feeling, the more so since we hit Levasseur impactite shores only towards the end of our trip. The sky showed rainbows ad nauseam, sometimes a jet contrail, but never an impacting comet or asteroid (fortunately). The ring is much too large to show obvious circularity; our daily navigation went along straight trajectories connecting capes and islands. The lake is wide enough that the Earth's curvature hides the far shores except for frequent mirages lifting, stretching, and reversing them into visibility. Only by inspecting our Google Maps prints were we aware that the lake curves around the far horizon, visibly so but only if one knows it. We traveled in a circle, but it didn't look like one. The clearest indication was that sunrise and sunset migrated slowly, from day to day, around the lake and our shore-facing tent as if the celestial sphere revolved azimuthally around us, in addition to its diurnal polar-axis spinning. And that I needed a compass to ascertain whether the wind shifted between successive camps.

Reservoir level: beforehand I was much concerned that the shores would be ugly bare rock or mud, as so often the case in non-full reservoirs. The graph below, for which I got the data from a Hydro-Quebec official long after our trip, illustrates the yearly variation. The range between highest and lowest in 25 years amounted to 17 m, but habitually every winter the lake is lowered by 3-7 m during the first months of the year to feed more power to then-cold Quebec and then refills with late-spring melt runoff. When full enough the level is apparently held roughly constant until the next winter. Another Hydro-Quebec official indeed emailed us beforehand that the level would be maintained at 349.6 m during August 2006, but he had no idea how bare the shores would look and I had no idea what to make of this particular level, not yet having the data plotted below. However, the graph shows that during our trip the lake was rather full, a few meters above the average over the last decades. I guess it wasn't emptied much this year or refilled quickly (I received no data beyond 2005-01-01; I asked Hydro-Quebec to put the actual and past levels on the web but got only a phone number in answer).



Twenty-five years Manicouagan Reservoir water level. Ticks at January 1 of each year.

Vegetation: thanks to the high water level, the shores appeared quite natural with grasses and low shrub down to the water. They were often very beautiful. There were good landing beaches wherever the coast is not steep, usually with sand bars a few meters higher up that are well-suited for camping. Larger bushes also grow at this height. Yet higher up the coasts are covered everywhere by an enormous wall of thirty-year-dead tree trunks

stacked on top of each other. When the lake was inundated during the 1970s there was no pre-emptive logging; the trees that then floated up now ring the ring at the very high levels the lake had in the early 1980s and presumably before then (no data received). Behind this dead-tree wall starts a dense, often impenetrable boreal forest of black spruce with pockets of birch. The spruce and birch appear as dark and light green on the Google Maps images; orange turned out to mark burned areas. The Levasseur forest has never burned before 2005 but its pristine black-spruce stands have been partially converted into pulp (read toilet paper) by the infamous Kruger company after the Quebec government in utter wisdom (or corruption) reversed the earlier Levasseur assignation as ecological reserve. Kruger uses a large pontoon to ferry logging trucks across the South-West part of the ring lake. That Southern part of the central island is now crossed by logging roads and has been cut bare in numerous large swaths, as shown by the ISS images from space that are linked on my website. These also show the two immense burns from fires in June 2005 that no doubt are also thanks to Kruger – who subsequently fought court battles to be permitted to harvest the forest it burned.

Animals: our main worry was bears. We Europeans have no experience with dangerous animals other than humans. No risk from the latter on this trip, nor from grizzlies, but a black-bear claw swipe through the thin skin of our boat might leave us stranded and a swipe through ourselves might leave us much worse. The standard advice to hang all food from a tree does not work in the meager boreal forest. I had planned to store the food overnight in the boat anchored offshore, but we didn't try this as being too risky in gusty wind or high surf and as too laborious (heavy boat) and cold (wet feet). So we kept the food bags at some distance from the boat and from the tent, we wore whistles, we slept with bear spray and a toy klaxon between us, and we camped on small islands wherever feasible. In addition, our food bags are pretty airtight, the wind was mostly offshore, there were no berries on the shores, and the dead-tree-wall is a noisy boobytrap. The upshot is that we never noted any sign of bear whatsoever. But we also saw no moose whereas some Levasseur beaches showed fresh moose tracks, and the one day that we were cooking in on-shore wind a fox came sniffing us out. In fact, the only animals that bothered us were the other black variety: the ubiquitous black fly. They are larger than European midges and take a bigger bite; they took a heavy toll the first day when we weren't yet aware of what they do to you. After that, we usually donned mosquito nets on shore and cooked dinner on windy capes. They did not bother us on the lake or during the bad-weather days spent reading in our opened tent: they quickly settled on the fly sheet inside to be gently rolled to death under my thumb (indulging in frequent fly-on-fly killing sprees). Virtually no mosquitoes, presumably already gone in August.

Birds: rather disappointing – my bird book served primarily as reading material when I finished the novels we brought. Osprey, bald eagle, merganser, heron: just one or two. More geese, and many loons – the latter most curious as to what we might be doing on their lake and accompanying us over long distances, calling incessantly, loud and melodious, a lovely sound. I wish we had that splendid bird here in Europe.

Geology: the molten rock ("impactite", the fourth rock type next to igneous, sedimentary, and metamorphosed) is phenomenal! There are abundant smooth impactite flats, polished by ice, that at first sight appear similar to the granite plates in the Baltic (for example those making up the eminently kayakable Åland archipel), but the impact melt is beautifully adorned with inlays of harder rock (gneiss, granite, quartz) varying from football size to microscopic grains. The hard impactite fractures in glassy fashion, like obsidian, and produces vertical cliffs with basalt-like columnar breaks. Such impactite flats and cliffs are only found on the central island and the adjacent smaller islands. The outer coast of the ring lake doesn't have impact breccia but does show impact moulding and fracturing, also along the road.

Access: the only road to Labrador (Route 389 from Baie Comeau to ghost-town Gagnon) skirts the Eastern side of the ring lake. It is paved until the dam, 60 km south of the ring, and then becomes a wide dirt road of good quality but with many high-speed trucks throwing up terrific dust clouds and terrifying rock sprays.

The reservoir is accessible per rough track just beyond Relais Gabriel, an isolated truck stop at half-past-three viewing the ring as clock.

Our equipment: we boated in a Klepper Aerius II two-person folding kayak. Traditionally, such a foldboat provided the means to boat all over Europe by train: when we were young we so kayaked the Danube, Rhône, Ardèche, and the coast of Corsica (we are sexagenarians on this trip). Nowadays, a foldboat provides the means to boat all over the world by plane: we habitually use our Ally folding canoe on Utah rivers (White, Green, Red; Blue on the to-do list) and we took our Klepper to New Zealand. For this trip we packed the boat, spraydeck, lifevests and paddles together with our camping gear and clothes in four sacks of 23 kg each which we were allowed to take without surcharge or security issue on Air Canada flights from The Netherlands to Halifax and back. In Halifax we borrowed a car from a helpful niece and bought food for three weeks. The Bulk Barn in Bedford offered excellent weigh & pack-yourself pasta, rice, and mashed potatoes for dinner, and oatmeal and dried fruit for breakfast. Pete's Frootique had compact vacuum-packed German rye bread for lunch (we don't like freeze-dried ready meals: too expensive, too much packaging, never the right portion.) We packed the bulk food in freezer bags and these in waterproof roll-and-click-closure kayak bags; short thin cylinders are best for stowing below the fore and aft decks of a foldboat. Our three-week food supply turned out to leave enough space that we might have brought more (such as more wine). The kitchen bag, tent, sleeping bags and books bag also went underdecks, but we used our clothes bags as cushion on our versatile Crazy Creek seats in the cockpit.

Cooking and fishing: we drank the lake water straight and cooked on a Camping Gaz burner with gas cartridges (2 per week) from Canadian Tyre. Firewood is most excessively overabundant, but we find cooking on fire too slow and laborious and in fact never made a fire on this trip – the weather was either warm enough or too windy to sit outside. We also prefer to leave no trace of our passing. We tried a few times to catch fish by trailing a lure, but without success. The lake trout is famous for abundance and size but we didn't take time for more serious fishing, being too busy paddling.

Navigation: no GPS, radio, or other electronics. I mounted a small car compass on the spraydeck but it mostly served to determine the wind direction for trying to predict the weather. We ordered a topographical map (sheet 22N, 1:250.000) via the web (link on my website) which is adequate; the larger-scale sheets add more contours but are not worth their cost. However, our printouts of Google Maps satellite images turned out to be much, much better. They show the water line precisely and indicate reliably where one may land and camp easily: namely everywhere where the shore is imaged whitish over more than one pixel. The pixels were just resolved on my page-size color prints at about 1:84000 scale. Ten prints covered the annulus and were our very satisfactory navigation aid. The topographical map served only to establish their scale and to mark our campsites.

Safety: no wetsuits, flares, pumps, etc. All are useless in such utter isolation. We saw no other people at all at any distance, and only after two weeks did we find a piece of plastic washed up on a beach. The only signs of humanity (apart from the very existence of the lake) were rare jet contrails in the sky, the Kruger logging company landing site (located at half-past six on René Levasseur and deserted but for a pickup truck with keys in the ignition), and occasionally a glimpse of a winter hunting lodge on a distant shore. Our boating safety relied obviously on being certain not to capsize. It is hard to capsize a Klepper (a wide fully-decked two-person kayak with airtube-tensioned sides that bulge out into formidable end-stability but may become a handicap in parallel breakers), but even so we were conservative in choosing when to boat and careful in pointing straight into waves and avoiding surf and surfing. We brought a satellite phone to call for outside help in case of illness or on-shore disaster, but we used it only to now and then tell my sister in Halifax that we were alive and happy. We rented it with fear of bears as main motivation, in Halifax at considerable cost. (In hindsight, a GPS sensor

might be useful to direct the Mounties more precisely to the rescue than "second bay on the West side".)

Trip detail: a sketch of our itinerary with camp sites and number of nights per camp is added below. We had lost three days on car trouble before this trip (returning to Halifax from a CAMMAC music camp near Montreal) and so we were on a tighter schedule than planned and paddled about seven hours a day whenever the weather permitted boating. We had intended to have well over three weeks; in the end we kayaked on thirteen days and spent almost seven days sitting out too strong winds.

We had hoped to also investigate Memory Bay and to hike up Mont de Babel, but we didn't have the time. In hindsight, we should have borrowed the lonesome car at the Kruger landing to investigate and photograph Kruger's devastation of René Levasseur's interior. (After checking the car out – a month later a Kruger driver drove into the lake at the other landing and drowned; his truck brakes weren't working, a fault Kruger knew about but had ignored.)

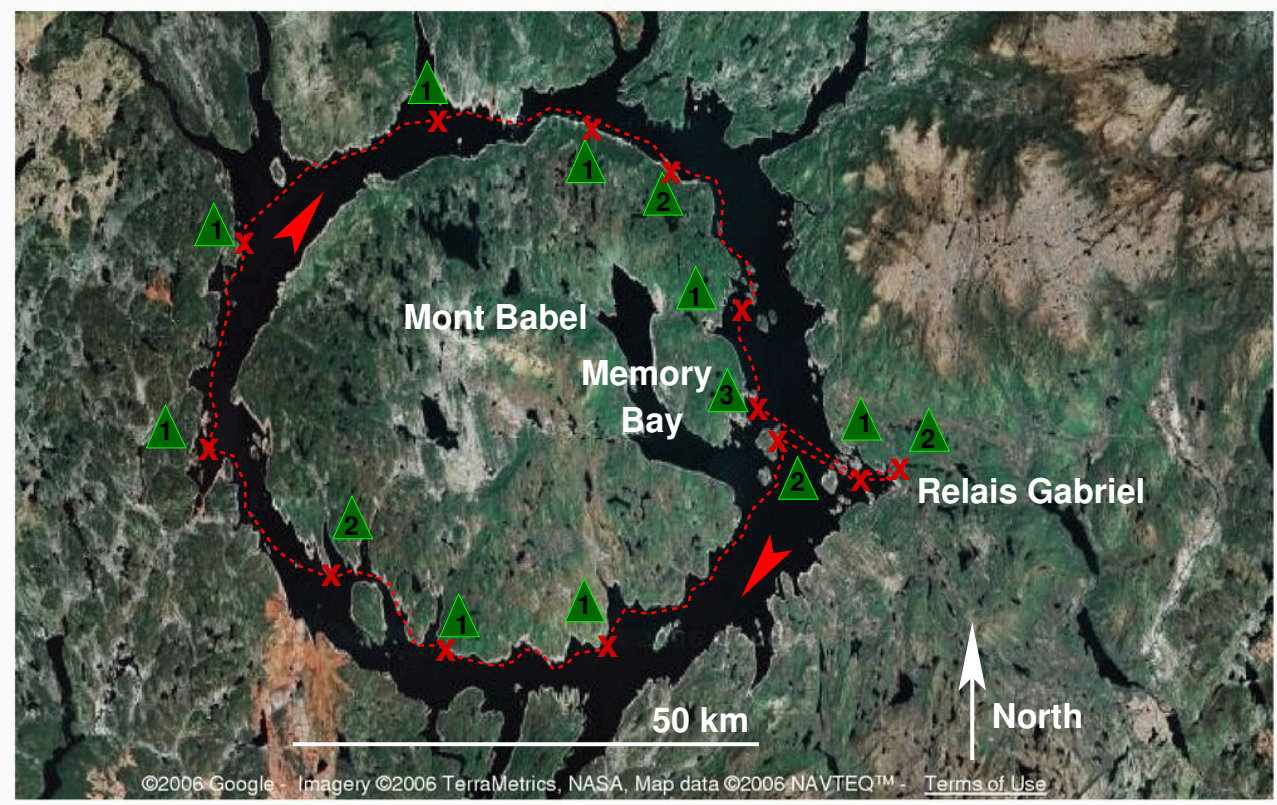
We drove up from Halifax in two days, taking the Matane – Godbout ferry over the St Lawrence early on Sunday August 6, 2006 and the excursion at Manic-5 that afternoon. The entrance to the Manic-5 exhibition is hidden at the backside of a forbidding building along the road; inside one registers for a guided tour with one's passport. The exhibition and the tour are nice, although given in Québécois that is fairly incomprehensible to French-French speakers. Taking photographs is strictly forbidden, an irritating and silly security measure. I wasn't even allowed to inspect a gull through my binoculars. The meteor impact was never mentioned, and I got no sensible answer as to how much of the hydropower now goes into dam cooling. Later, we also visited the Yangtze Three Gorges Dam where photography is welcome, the guides speak better English, but the generators are not on display while here you visit the older set.

Driving the dirt road from the dam to Relais Gabriel on a Sunday turned out a good idea because then there are fewer trucks – as we found out on the way back on a Friday, getting one car window shattered and another damaged by stones kicked up by passing trucks. When we arrived at Relais Gabriel, the proprietress (Mme Claire Simard), although politely addressed in French, had no interest in us or in our plans and specifically did not want our car parked anywhere near her spacious access ramp. She directed us instead to the deserted public launch site opposite hers, down a bad track that gave us trouble coming up on the way back. We left our car there in the hope that no humans or bears would tamper with it during the three weeks, with a note on the dashboard explaining what we were doing, when we expected to be back, and whom to phone (my sister) if we wouldn't. When we got back we met a much friendlier lady of nearby Poirvoirie Boreal 51 who had noticed the car and its Nova Scotia license plate and had phoned the Halifax police before our note was noted. The Poirvoirie Boreal 51 (weblink on my website) is half an hour by boat from Relais Gabriel and offers cabin and motorboat rentals to trophee anglers. Since 2016 there is also accommodation at Station Uapishka, further North on the East shore.

We had driven from Godbout to Relais Gabriel in excellent weather but arrived together with a front in the sky bringing tremendous rain and gusty winds that evening. The following day we mounted our boat but camped another night at the launch site waiting for the still very gusty wind to calm down. The next day we crossed the lake against a stiff breeze, to the large island off the entrance to Memory Bay. We then had to sit out another bad-weather (wind and rain) day there. Overnight the wind went to the North and looked as if it would stay there, so next morning, just before starting we reversed our plan and chose to circuit clockwise. The next three days brought us, indeed with persistent Northern wind which delivered cold temperatures as well as heavy rain squalls and hail showers, to half-past-seven on the circuit (we measured our progress not in kilometers but in hours on the circuit clock). There we met the same Northern wind as stormy headwind through the Western ring half, and settled down for another wait – getting worried not to complete the circuit in time for our flight

back to Europe. Fortunately, the wind went West the next morning and stayed there.

We crossed over into the wind to the outer Western shore and hugged that for two days while the West wind remained strong, bringing frequent afternoon thunderstorms sometimes missing and sometimes hitting us. The worst we rode out in the lee of a convenient cliff. The wind then weakened into a regular nice-weather breeze which pushed us gently through the Northern part of the ring. We could short-cut the very wide bays to the North without risk, smoothly riding the wind into the shelter of the central island's Northeast coast. The latter is relatively unattractive except for its impactite cliffs, but gave us easy going during some rainy and then two gloriously sunny days all the way to a small island North of the entrance to Memory Bay. However, there we needed our full reserve of three days, built up in the meantime, to sit out winds that were much too gusty for crossing over to Relais Gabriel. We camped in the shelter of Isle René Levasseur but hour after hour and day after day, the formidable open reach downwind showed far too high whitecaps through my binoculars from the top of our little island. On the third day, running out of time, we ventured out just before dusk when the wind usually diminished. In leaving the protection of Isle René Levasseur the waves quickly became higher. Nearing the Northern tip of the large island off Memory Bay we had high swell but no breakers. However, when we struck out for the remaining 6-km crossing a large rainstorm in the North brought much fresh wind producing breaking rollers all over the lake. Fortunately we could ride these nearly in their running direction. They swept past us as huge mountains, their crests noisily breaking around and under us. On these, Rietje paddled at speed to maintain rudder steerage while I slapped down brace strokes into the wild foam. In the wave valleys we scrambled to gain the windward height needed to pass on the high side of a forbidding booming-surf island cape on the other side of the annulus. We just made it, riding big ground seas through the passage along it and then, in near dark, around a windward island into the abrupt calm behind the latter. Phew!



Itinerary with number of nights per camp.

Day two: lay-over on the largest island off Memory Bay, viewing South-East.