

Report on Storm Babet in Granton Harbour

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1 INTRODUCTION

In 2012, before I became involved with Granton Harbour, there was a strong Easterly storm that is still talked about. It washed a number of boats on swinging moorings in the West Harbour onto the shore. Many were badly damaged, some sunk. It was said to be a “30 year storm”. In November 2021, the named storm Arwen put at least two boats on the breakwater and damaged many others. It also finally sunk the yacht *Runagate*, originally owned by the author Nevil Shute and in very poor repair, in the West harbour.

Storm Arwen was a near-miss for Granton Harbour. One local boat, *Oyster Catcher* was lost. *Runagate* had appeared in the harbour some weeks previously, carrying a rich history in a very unseaworthy state, was poorly secured and the owner absent. When it broke its moorings it was only due to quick thinking was it managed to a part of the harbour where it would not become a hazard. It very nearly sunk in the very spot that one of the yacht clubs, the Forth Corinthian Yacht Club uses to crane boats in and out of the water twice a year. Arwen also happened in November, after the majority of boats were ashore. If it had happened a month earlier, the outcome would have been much worse.

Granton Harbour is, above all, a diverse and vibrant community. There are two yacht clubs with a friendly rivalry who cooperate in managing some shared resources and joint races. There is a rowing club and there are sea cadets. There are lobster and mackerel fishers. There are commercial operators and pilot boats. There are harbour seals and people who watch over them. There are swimmers and, rarely, surfers on the other side of the breakwater in Wardie Bay where some of our markers for the yacht races are. There are a handful of independents, some of whom have been based here longer than anyone can remember but still, in their 80s, regularly check their lines and tend to their boats, and some who are recent arrivals and rescue and rebuild sunken boats and help maintain shared harbour infrastructure. There is a public slipway from which anyone can launch a small boat and sail. There are numerous, albeit fewer than in decades past, small and medium-sized local businesses who support the harbour with everything from advanced experimental prototyping to skilled fabrication. This is the only place in Edinburgh, Scotland’s capitol city, where the sea is accessible for this variety of activities. Granton Harbour is more than a collection of moorings and boats. It is a unique and culturally important part of Edinburgh.

In mid-October 2023, less than two years after storm Arwen, a low pressure system was named storm Babet. Whilst wind speeds of Babet did not approach those of Arwen, it produced a pathological sea state in the Granton Harbour that did substantial damage. Five boats sunk, two more nearly lost, at least a dozen badly damaged, and many more escaped with minor



Fig. 1. UKHO chart detail showing Granton Harbour. The extra marks are as follows. **W** is the original position of *Hale Kai's* mooring. **X** is the position shown in more detail by Figure 2. **Y** is the general area where many vessels were damaged. **Z** is the position of the *Shearwater*. Note also the position of the yellow marker just Southwest of **W**.

damage. Parts of the pier were damaged. The wreck of *Runagate* finally broke up. Thankfully, nobody was injured or lost their life.

These storms are happening frequently. Climate change means they will happen more frequently, with increasing intensity, and earlier in the year. Granton Harbour is vulnerable. If we want it to remain a viable as a base for sailing, rowing, fishing, boat repair and ideally a refuge in storms, we need to take active measures to make it less vulnerable. We need to do this as a whole harbour community, pooling our resources and capabilities. In section 7, drawing on my experience in relief operations following natural disasters, I mention some of the ways we can do this. There are surely others. The crucial point is that we must work together as a community of harbour users and not as individual organisations and individual boat owners. That is the path to resilience. This will not be our last storm.

The remainder of this article is structured as follows. Section 2 is an overview of the setting. It discusses the layout of Granton Harbour and the organisations and other harbour users present. Section 3 describes my own vessel, *Hale Kai* and connection to Granton. Section 4 gives a general overview of storm Babet and the situation it created, with wind, tide, and sea state in the harbour. Section 5 is a rough chronological log of events from my perspective as I experienced them and is primarily concerned with the sailing yachts *Bella* and *Hale Kai* as well as the two fishing boats that arrived from Port

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Seton seeking shelter after having been refused at Leith and Burnt Island. Section 6 describes some of the damage and likely causes. Section 7 makes some specific recommendations about how we can reduce the vulnerability of the harbour. Section 8 is a personal meditation on judging risk and decision-making in situations such as we found ourselves in. Finally 9 comments on community response to weather events and disasters in general.

2 GRANTON HARBOUR

Granton is a tidal harbour on the Firth of Forth, just across Wardie Bay from the industrial harbour at Leith and the small fishing and recreational port at Newhaven. It has two breakwaters, East and West, and a central pier (called the Middle Pier) shown in Figure 1. The West harbour used to be much larger and much of it has been filled in. The water is ultimately the responsibility of the port authority, Forth Ports, whilst the land and pier are owned by a private property development company. Various organisations lease parts of the pier for different uses.

The part of the West harbour nearby to Middle Pier does not dry, retaining about a meter of water at spring low tides. Recently earthworks were started and then aborted resulting in more of the West harbour near the shore being partially filled or silted than is apparent on the chart. Three fibreglass yachts, *Tonnag Mhor*, *Hazel* and *Laphroaig* are moored against the pier there, as is a steel fishing vessel, *Myra G*, and a small barge or raft, and occasionally other boats. At the beginning of the storm, *Orphan*, a Cutlass 27 rescued after having been sunk last year was also moored there.

On Middle Pier itself is the Forth Corinthian Yacht Club's boat yard. It has access to the Western side of the pier at the South end of the West Harbour for stepping and unstepping masts and for lifting in and out boats twice a year when a crane is hired. Most of the yachts were still in the water; the lift out, scheduled well in advance, had to be postponed due to the storm. There is unused land to the North of the Corinthian yard.

The hammerhead at the end of the pier is currently unused. There is a narrow channel leading from the harbour entrance to the East side of the pier where two pilot boats are normally moored. On the Pier above the pilot boats' moorings is the Pilot station. Beyond the pilot boats are usually *Conserver* and *Girl Grey* of Seahunter Marine. *Conserver* is used for surveys, salvage, and work of that type, and *Girl Grey* for fishing and wildlife tours. *Conserver* is often hired to assist with work around the harbour, lifting and placing moorings, salvaging sunken vessels and so forth.

Continuing Southward along the pier there is a pontoon owned and operated jointly by the two yacht clubs, the Corinthians and the Royal Forth Yacht Club. Some boats winter on the pontoon and some others were temporarily berthed there waiting for the Corinthian lift-out.

South of the pontoon is the public slipway. It is used for launching and recovering dinghies and small motorboats. It is also used for maintenance. *Bella*, an 11m steel ketch of Dutch design was on the slipway before the storm being restored by K—. At the top of the slipway is a 5 ton crane belonging to the Royals. Below the crane, and set back is a second slipway leading into their yard. Across from the slipway are pontoon berths for club boats. A gantry leads down from a separate pier connected to their yard. This is better understood by examining Figure 2.

To the South of the Royals' yard, there is another public slipway known as the "South Slip". The 150 ton *Shearwater* dredging vessel was moored against the South Slip (Figure 1Z).

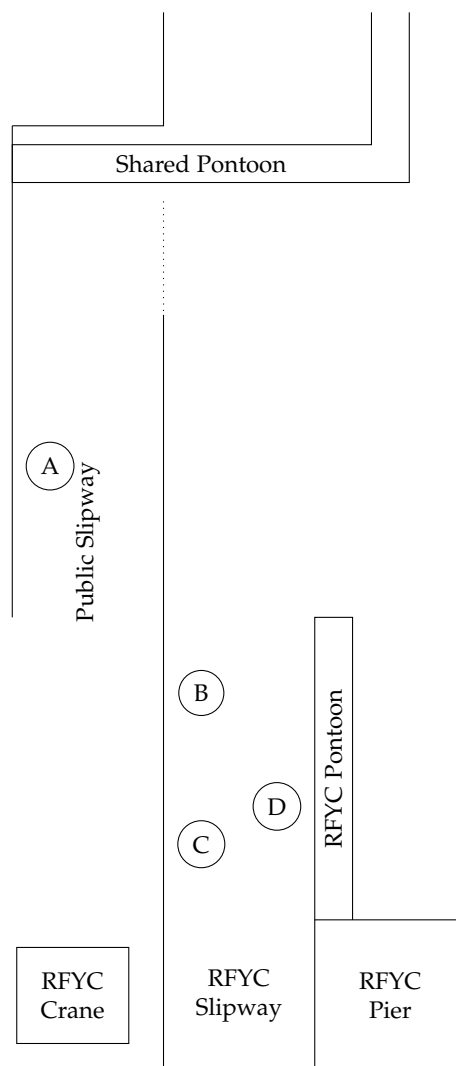


Fig. 2. Diagram of the pier, slipway, and pontoon arrangement nearby to the public slipway, corresponding to Figure 1X. Approximate positions are marked for, (A) *Bella*, undergoing maintenance before the storm, (B) and (C) the fishing boats that sought shelter, and (D) the RFYC workboat that capsized.

The East harbour has small craft moorings. It is separated into zones. Generally closer to the pier and towards the harbour entrance belong to the Royals. Closer to the breakwater and in the shallower part of the harbour are the Corinthians. Royal moorings are generally but not always laid in trots, connected together with ground chain, with heavier chain closer to the harbour entrance and lighter in shallower water for smaller craft. Corinthian moorings are generally constructed from concrete and steel sinkers, heavy ground chain, and a lighter riser chain. The Royals had lifted out many of their boats the previous week so many of their moorings were unoccupied.

3 HALE KAI

About six or seven years ago, I decided that I needed to learn about the sea to understand something about climate change. It was obvious to me that I needed a boat. I read every book I could find from instructions for navigation and sailing (I had sailed dinghies once or twice as a child, little more), travelogues, boatbuilding and repair, surveying, technical standards. I joined the Corinthians because it is less expensive than the

Royals; the club motto is “affordable sailing for all.” That sounded like me. I practiced sailing as crew on some races. I made friends.

I purchased *Hale Kai* in 2019, somewhat neglected, but mostly sound. The design is from Maurice Griffiths, robust and proven, big and comfortable enough to be suitable for eventually living aboard, but small enough to sail single-handed. There was plenty of space aboard for pursuing my scientific interests: developing alternative and power generation systems, novel low-cost scientific instruments that can help crowd-source environmental data for better understanding the effects of climate change on marine ecosystems, and decentralised communication systems. But, *Hale Kai* as in Inverness and I was far too green to make the delivery to Granton on my own. Friends from the Corinthians helped me sail from Inverness to Granton.

After a summer and winter in the Forth, *Hale Kai* was lifted out into the Corinthian boat yard. A proverbial “previous owner” had fitted a bilge pump in the worst possible place which weakened the structure. Fixing this meant rebuilding the entire aft end of the cabin, companionway and bridge deck. And old, poorly executed repair to the rudder meant rebuilding that. The standing rigging was at least 30 years old so I designed a new rig using modern synthetic rope. This implied designing new mast fittings. This, as well as a slew of smaller improvements took two years and would not have been possible without the enormous amount of help of friends from around Granton. It was a steep, but very rewarding learning curve.

This past spring, 2023, *Hale Kai* was returned to the water. A serious problem with the engine was immediately apparent. The manufacturer (Beta Marine) did not think it was repairable. It was now time to learn about diesel engines. We rebuilt the heat exchanger for less than £100 in parts. Granton ingenuity. This particular repair served very well in Storm Babet. We installed a “Cape Horn’ wind-vane self steering – I have a design criterion that says the vessel should be able to sail itself without engine or electricity. In August, I set off on a 250 mile round-trip shakedown cruise, single-handed to Peterhead, in company of another Granton boat, *Orphan*, as far as Anstruther. I was joined by a friend from the Royals on the return passage from Peterhead. The shakedown cruise went very well with no major problems.

4 STORM BABET

Storm Babet was named on the October 16th 2023. The UK Met Office issued red warnings of rain for parts of Angus and Aberdeenshire, and amber warnings for wind and rain for most of the East coast of Scotland, including where Granton is. The weather system settled in such a way as to lash the coast with Easterly or Southeasterly gale-force winds and rain for nearly three days from Wednesday the 18th.

In Granton, the winds were from an Easterly direction, veering Northeast on Saturday. Wind speed was typically force 8 or 9 with gusts as high as force 10 throughout the storm. There were high winds overnight on Wednesday, moderating Thursday during the day and picking up again in the evening. Winds gradually decreased from the small hours of Saturday until noon.

The sea state in the East harbour was pathological. Though the winds were from the East, for a couple of hours either side of low tide, and especially on the flood, breaking waves about 1-1.5m high formed within the harbour travelling South. The breaking waves would form depending on the water depth.

This meant that they would initially form in the deeper near the harbour mouth. As the harbour filled up, the waves would form deeper and deeper in. In these conditions it was too dangerous to move around the harbour.

By half tide, the breaking waves would no longer form. Whilst there was still significant swell, the conditions in the harbour were much more manageable and, with care, moving around would become possible. This pattern held throughout the storm.

The direction of the waves, at right angles to the wind direction, were particularly bad for some boats. Those who tended to point into the wind took the waves beam on. The 36’ classic wooden yacht *Errant* was particularly susceptible to this, developed a hole in the coachroof and was eventually sunk.

Meanwhile, in the West harbour, there were no breaking waves. But much of the time the swell created a surge near the pier.

5 TIMELINE

The following account was mostly written a day and a half after Storm Babet, Sunday, October 22nd 2023. Times are approximate and based on my recollection. I did not keep a running log. It is based on my first hand experience and I do not address in detail others’ activities.

5.1 Wednesday, October 18th

I was away in Cambridge on Wednesday for a conference on epidemiology. The storm had been forecast well in advance. The Corinthians had been planning to lift the boats out on Saturday, October 21st. Last Monday at the annual meeting, the consensus was that it was probably a good idea to postpone the lift out. I left the conference early to be present for the storm.

5.2 Thursday, October 19th

I arrived back in Edinburgh late Wednesday night, and slept. Overnight Wednesday there were some high winds ahead of the storm. Higher than I had expected. I do not know first hand what happened overnight. When I arrived at the harbour, around low tide, people were at work.

5.2.1 The shared pontoon

There was damage to the shared pontoon, with pins that had popped out on one. The pin did not have a hole for a clip or split pin to retain it. I helped hammer it back in. PT—— had found my old, discarded anchor chain in the yard and used it to lash the cleats on either side. I am grateful that I had not taken it to the scrapyards as I had intended.

Several boats were on the pontoon. *Hirta*, PT——’s Rival 35, recently returned from a 6000 mile Atlantic circuit was there. *Milly M*, the green-painted tiny fishing boat with a 75bhp engine that is prone to sinking was there. *Misty Blue*, the racing boat that wins many of the races, was there, rudder badly damaged from a collision with another boat overnight.

One small sailing boat, I forget which, was on the pontoon with the owner away. It was tied properly but not secured for a storm. PD——, K——, and I put it back on the its mooring.

Generally, people were rushing about securing the boats on the pontoon and doing other similar things.

5.2.2 *Bella*

There are some boats in the harbour that are special cases. *Bella* was on the public slipway (Figure 2A). K—, who stays in the van often parked above it, has been painting and restoring it for several months. It has been previously affiliated with the Royals. Its hull had been scratched by the wall overnight and it had lost most of its fenders and fender board. It could not stay there. We could not move *Bella* until close to high tide.

At length, the tide was high enough to move *Bella*. We decided to move to the West Harbour, and tie up against the pier in the corner, by the ladder underneath the gantry used by the Corinthians for stepping and unstepping masts. K— and I were aboard, and numerous people ashore to cast us off and ready to take lines on the other side.

Once alongside the pier around slack tide, it was clear that the surge in that spot was too great, and mooring there was untenable. We abandoned that plan. We were offered a Corinthian mooring in the shallow end, recently vacated by the trimaran *Lady Nadonna*, now ashore above the slipway where *Bella* had been. G— suggested to set an anchor as well. We did not do this. It was a good idea but I do not believe that in the end it would not have been enough.

I noticed that *Conserver* and *Girl Grey* were moored against the pier in the West Harbour. It was a plausible tactic of sheltering there from an Easterly wind, protected by the breakwater and the pier. They must also have found the surge too great because some time later they returned to the East harbour.

5.2.3 *Orphan*

Next, *Orphan*, the Cutlass 27, another former Royal boat that had been rescued and restored after sinking last year, was rafted outside the B— brothers' three yachts, *Tonnag Mhor*, *Hazel* and *Laphroaig*, which themselves were rafted onto the steel fishing boat *Myra G*. That was a bit much and the B— were understandably worried. So we climbed down the dodgy ladder, onto the fishing boat and across to *Orphan*. As we took it around to the East harbour, to put it on a Royal mooring, we saw a piece of the wreck of *Runagate* floating free and made sure to avoid it.

By this time, it was after nightfall, which comes early this time of year. Most people went home. A few of us who live nearby stayed around.

5.2.4 *Fishers of Port Seton*

As we rested from moving the boats, we somebody say that a couple of fishing boats had come in and were trying to tie up in the West Harbour. A short time later, some very bright lights came into the East Harbour, dead slow. At first we thought it might be the big workboat, *Conserver*, manoeuvring for some reason. It soon became clear that one of the fishing boats, *Zephyr*, was intending to tie up alongside the shared pontoon. They came alongside and crunch, the emergency boarding ladder for the pontoon was bent. This vessel was much too large for the pontoon.

"No, no, no," I said, "you can't put that here, it will take the whole pontoon off."

The fisherman asked the obvious question, "where should I go then?"

We discussed the possibilities. One possibility was the public slipway (Figure 2A). But *Zephyr* is wooden and would get broken against the cobbles near low tide. The options were dwindling as the tide went out. Berthing against the *Shearwater* way down at the far, shallow end of the harbour by the South Slip (Figure 1Z) might be possible, but it was not obvious that

there was enough water left to safely do that. As it turns out, the *Shearwater* would be surging at least 2m fore and aft on the flood tide. Berthing alongside would have been a very bad idea. Another possibility was to proceed upriver to Port Edgar, but *Zephyr* did not have charts for that part of the Forth, and we advised that the Drum Sands are a hazard on a falling tide, and the currents where the river narrows under the bridges can be strong.

The master of *Zephyr* decided that the only spot that made sense was on the other side of the public slipway, near to the crane that belongs to the Royals (Figure 2C). *Zephyr* came alongside the slipway and the fisherman threw us a stern line which we secured to one of the rings embedded into the stone.

We asked for a bow line. The fisherman explained that the cleat that he usually uses had ripped out of his foredeck back in Port Seton. The same had happened to his brother, in the other boat. We turned and saw a second fishing boat coming down the harbour towards the Pier. He explained that this damage had caused them to leave Port Seton and seek shelter elsewhere. They were refused at Leith and Burnt Island, neither willing to open their sea gates. Granton does not have sea gates, nor does it have anyone who would refuse them, so here they were.

We managed to find strong points for tying the forward ends of the boats, but they needed spring lines to stop them surging back and forth. We asked for more lines. The fishermen had none immediately available. We explained what spring lines were and how they could be used to arrest this motion, and they found some bits of rope that would suffice for immediate purposes but which would probably chafe through or burst. We recommended that they should go and find more lines.

It was now getting late. There was nothing to be done in the hours around low tide, the sea state in the harbour was too dangerous. Once the fishing boats were as secure as they were going to get with what they had, I went to get some sleep.

5.3 Friday, October 20th

The next morning I looked at my phone after making coffee to see the messages from K—: "Bella is dragging," "I need help," "You're dragging." I replied "F***," and did not finish my coffee.

5.3.1 *Hale Kai*

I got to the harbour to find *Hale Kai* quite a ways from the normal spot (Figure 1W), to the Southeast of the yellow marker on the chart. It appeared that the mooring had caught on one of the Royal's ground chains. *Hale Kai* was on the mooring marked W, one of the sinker and riser type. That was what happened, but fortunately after 50m or so, the sinker fouled on a Royal ground chain and it stuck there until the tide fell. This was good, because the dragging was arrested, but it was obviously a temporary reprieve and would not hold for the next tide.

5.3.2 *Bella*

Bella had come to rest way down the harbour, almost at the *Shearwater*. K— had managed to grab a second mooring as *Bella* dragged, and this slowed progress a little, but not completely. On the rising tide, a collision with the *Shearwater* was inevitable unless we could do something.

5.3.3 *Planning a rescue*

I sent a message on one of the Corinthian chat groups suggesting that there was likely to be a window later where we could move about the harbour again, and put things back into a safe

state. Nobody responded. Somebody conveyed to me that they did not think it was safe to do anything to try to save the boats. I thanked them for their concern and replied that I would keep an eye on the conditions and make that decision when it came to it. This process of planning and judging risk is discussed in Section 8. For now, it was time to make a plan.

If I could get my anchor out, past the Royal ground chain, I could purposely catch on it more securely than the sinker could, being the a better shape. I also had a 75m spool of 16mm anchor rode that I could possibly use to grab another mooring. It is harder than it sounds to carry out an anchor and chain by dinghy and in those conditions nigh impossible. In any event, it would not had worked because by the time the tide had risen enough that the breaking waves stopped, *Hale Kai* released the ground chain and continued wandering down the harbour.

5.3.4 *Royal tenders*

The gangway leading to the Royal's pontoon (Figure 2) had collapsed. This is where they keep their small open boats used as club launches, the race official boat, and the workboat. These boats were now inaccessible from shore. The capabilities of these boats could have been useful – they have more powerful engines than the Corinthians' launches. I called P—, the Royal boatman, and offered, when conditions allowed, to take him over there to fetch one or more of them to put it on the shared pontoon where it would be accessible. He refused saying that the boats would not be going out in these conditions so there was no reason to move them.

5.3.5 *Zephyr*

Meanwhile, the fishing boats had burst some lines again. M—, from Forth Ports was there surveying the scene. I filled him in on what happened. He agreed that where they had tied up was the only reasonable place. He said that the fisherman from *Zephyr* had called the coast guard at 3am in distress. The boat was taking on water and leaking fuel. Seeing as there was no immediate threat to life, the Coast Guard had nothing to do. The fisherman, having been told by the Coast Guard not to re-board the boat, could not set the bilge pump going. Why he had not set it going as soon as *Zephyr* had started to take on water I do not know. He had then left, believing it lost, resigned and unable to watch it sink.

A short time later, the fishing boat *Zephyr* had turned, bow out away from the wall, listing badly to port. The tide was coming in, with its characteristic surging. With the bow in this position, it was difficult to keep control of the boat, and it was in danger of bursting more lines or, worse, getting swamped. We tried to pull it in, with some initial success, to align it stern to the surge. We were not in time and a large wave came over the gunwales and *Zephyr* capsised.

5.3.6 *Timania*

I noticed, perhaps around this time, but I could be wrong, that *Timania's* trim was somewhat low in the bow. She seemed to be taking on water. The next time I looked, later, she was sunk.

5.3.7 *Tonnag Mhor, Hazel, and Laphroaig*

The B— brothers' three boats in the West harbour had by this time broken their bow-lines. They had rotated and were lying stern to the wind, at an angle of about 30 degrees to the pier. Their motion was surprisingly gentle, not surging much. It would not have been an easy matter to get more lines onto them. Somehow, in a relatively calm part of the harbour, free to lie as they were, connected only by one thin stern line each,

they rode out the storm. *Hazel's* mast broke at the spreaders overnight that night, but apart from that they suffered only broken rub-rails and scratches.

5.3.8 *Bella*

We headed over to the *Shearwater* to get a sense of the sea state at that end of the harbour and the situation of *Bella*. The sea was too rough to do anything and *Bella* had not yet lifted.

At length the sea moderated somewhat and *Bella* started moving. It was on the edge of being possible to go out to it in *Dumbo*, the Corinthian's club launch or utility boat. As we were considering this, looking out from the deck of the *Shearwater*, *Bella* had got close and started swinging her stern into the side of the *Shearwater*. *Bella's* pushpit was about level with *Shearwater's* deck.

The next bit is only possible to do when completely present in the moment. The rhythm of *Bella's* movement in the swell was predictable. With the right timing it was possible to jump aboard. For ten seconds or so at a time, a window appeared to basically step from one to the other. With the wrong timing it was possible to get squished between a 10 ton cruising yacht and a 150 ton dredger. K— jumped first, intuiting the right way to do it. I would not have considered it if I had not seen and understood how it could be done.

The calculation was extremely specific to that situation, the motion of those two vessels (not other ones), the state of the sea in that corner of the harbour (nowhere else) at that exact time (the combination of circumstances would not last long). It is not, in general, a good idea to go jumping between vessels in a storm. But in that specific situation, for a brief window of time, there was an opportunity and it was not unsafe.

I watched the next swing to get the timing and jumped on the following one.

K— started the engine and drove up, away from the *Shearwater* and on top of the mooring. I went forward to drop the pick-up lines (or "junks" as they are called locally). This was easier said than done because of the spaghetti of rope tying on second, opportunistically grabbed mooring. After what seemed like much too long, I managed to get the mooring lines free and, careful to avoid the ropes in the water, we manoevered up the harbour. We picked up a new mooring and could have quite happily rested aboard *Bella* indefinitely, but there was a problem: *Hale Kai* was now closing in on the *Shearwater*.

5.3.9 *Hale Kai*

We had watched *Hale Kai* collide with W—'s fishing boat *Thai Err Up* on its way down the harbour as we were moving *Bella* to a mooring. I think the bowsprit stove in a window. The stern port quarter received a nasty knock, bending the backstay chainplate on the port side and sending the outboard engine for the dinghy to the bottom of the harbour. This same collision did some slight damage to the windvane self-steering. But in full force collision, washing up with the swell against the *Shearwater*, *Hale Kai* would almost certainly be lost.

As I was contemplating watching the imminent destruction of *Hale Kai* from the deck of *Bella*, I— arrived in *Dumbo*, and ferried us across. Same procedure, this time with K— on the foredeck and me at the tiller. Picked up a mooring, a Royal one, inappropriately close to the marker for the end of a pier that used to exist and poses a hazard (Figure 1, marked Y). It was a poor choice of mooring on my part, but the wind and waves were in a favourable direction and kept us off the marker and the old bit of pier.

We called I— on the radio, informed that we were safe and could safely rest there. We had plenty of provisions and

comforts and could wait out the rest of the storm if necessary. There was no need to take any risks to come and get us. After some time, I—— collected us, and we were soon back ashore. We had a quick debrief and I went home to get some sleep.

5.3.10 *Shearwater*

The *Shearwater*, meanwhile, had started bursting lines. Ropes as big as my arm. Once there was enough water to lift it, the surge would cause fore-and aft movement of several meters. At one point it was held only by a bow line being blown onto the wall as the tide went out. As soon as it was safe and the tide low enough, N—— managed to get new lines on and a reinforcement to his pickup truck to prevent the mooring ring being pulled out of the pier. One cannot just leave such a gigantic beast and hope for the best, for the insurance company to compensate people for the immense damage it would cause were it to break free. N—— was present throughout the storm, sleeping in his car, actively managing the *Shearwater*, working with the tide, tending to lines, and also helping others.

5.4 Saturday, October 21st

I awoke at 6am and found messages from K——.

03:27 “You’re ok, Bella is on the move”

04:25 “I’m back on Bella, got squashed in between the dredger”

5.4.1 *Bella*

Overnight, *Bella* had dragged again and ended up pinched, bow first, between the *Shearwater* and the harbour wall. The *Shearwater* was not yet afloat, but the surge was sending *Bella* into the gap. Single-handed, K—— had jumped aboard and reversed out under full throttle, pulling two the two still-attached moorings with. Somehow this worked, and he managed to get onto yet another mooring.

By the time I arrived, the storm had significantly moderated and it was clear that by around the next high tide it would have dissipated. The other fishing boat, the yellow one decorated with “minion” cartoon characters (Figure 2B), had burst some lines again. J—— and W—— helped secure it again. We let K—— sleep for a few hours and then PT—— and I picked him up.

5.4.2 *Hale Kai*

By high tide, the wind had veered and *Hale Kai* was much too close to the yellow marker, about 3m away with it on the stern quarter, well within the swinging circle. Easily moved.

5.4.3 *Fishers of Port Seton*

The afternoon was benign. People arrived and started fixing things and cleaning up and inspecting damage and trying to work out just what happened. Several of us who had been busy during the storm were relaxing and chatting in the cockpit of *Hirta*. At one point I went up towards the facilities and I noticed that people were watching as the second fishing boat tied to the pier nosed out away from the wall. It had burst its lines once more. I demonstrated until the bystanders understood how to tie a rope around the plinth under the Royals’ crane and how we could tie that to the broken bow lines on the boat to stop it wandering.

6 AFTERMATH

6.1 Pathological sea state

In broad terms, the damage to vessels and the harbour was caused by the sea state in the harbour. This phenomenon of breaking waves travelling down the harbour at right angles to the wind is unusual. It is likely due to the geometry of the harbour and the exact direction and period of the waves in the outer Firth of Forth. Reports from Newhaven harbour, across Wardie Bay to the East which would normally be well sheltered in these conditions, are that waves were reflecting off of Granton’s Eastern breakwater and entering Newhaven. Understanding precisely what conditions can cause this wave behaviour in these harbours requires further research (e.g. hydrodynamic modelling). This will tell us if there is anything that can feasibly be done to prevent these conditions recurring.

Boats are not designed to take waves on the beam, still less if they are completely or partially stuck in the mud, not having yet been lifted by the tide. The two sunken yachts, *Errant* and *Timania* took a good deal of punishment in this way in the hours around low tide.

6.2 Dragging moorings

The steep sea experienced at times in the harbour, even when not breaking caused significant upward force on the ground tackle as the scope was suddenly exhausted. I personally participated in the design of *Hale Kai*’s mooring and helped to cast the sinker, about 550kg of concrete mixed with steel balls. It has a hemisphere shape that sinks into the soft mud and holds partly by weight, but mainly by suction. Repetitive shock loads such as were primarily caused by the breaking waves liquify the nearby mud, and the vacuum weakens and eventually fails. Once on the move, it is easy for a 7000kg boat to drag a 550kg weight through the mud.

The moorings of several the vessels near to position W in Figure 1 experienced a similar failure mode. Some dragged more than others. That part of the harbour was densely populated with boats which increased the chances of collision. There was significant damage to a number of vessels due to collisions and it seems likely that several will be declared a total loss.

6.3 Sinking of *Zephyr*

Two fishing vessels arrived unannounced to shelter. They were both single handed. They had both experienced damage to their deck hardware prior to arrival that made securing them difficult. Neither had adequate lines. The masters left at various times and did not tend to their vessels.

The part of the pier where we berthed them (Figure 2B and C), the only reasonable place to put them that we could think of, had inadequate strong points to tie onto. At least one (small) cleat was pulled from its bedding in the stone of the pier. The wooden pilings on the pier were in poor condition and some were damaged.

Once *Zephyr* began to take on water, in the small hours of Friday, October 20th, the master called the coast guard. There was no organised watch in the harbour and nobody around to help. He was correctly advised, since there was no danger to life, to remain ashore and not board the vessel. He left, believing the vessel lost and unable to watch it sink.

This was, in my opinion, an unnecessary sinking. We have several salvage pumps available and it could have been kept afloat. We could have had spare lines available to prevent it from taking the surge on the beam. Above all, we should have maintained an organised watch with an obvious point of contact where the master of *Zephyr* could have sought help.

7 RECOMMENDATIONS

There are two main recommendations that come from this experience. They come down to preparation and use of available resources on the one hand and organisation and communication on the other. If we are to reduce the vulnerability of this harbour, we need to organise and act as a community of harbour users, not as a collection of organisations who only work together in limited ways.

There are obvious recommendations relating to maintaining the pier itself. Doing that is fraught with complicated questions of ownership and requires significant investment and probably government support. Getting government support should not be difficult as a diverse and inclusive group of harbour users. But that is out of scope for this document: I focus on the things that we can do ourselves, at minimal cost, with resources that we already have, that will increase our resiliency.

7.1 Preparation and use of resources

When there is a significant weather event, forecast well in advance, we need to prepare. This preparation should happen with the perspective of the whole harbour. It starts with figuring out what collective resources we have. Resources include:

- Moorings (regardless of which club they belong to)
- Boats (club tenders and launches)
- Lifejackets, slings, and lifesaving equipment
- Rope, and knives to cut it
- Tyres or material that can be used as fenders
- Salvage pumps
- Fuel
- Handheld and fixed radios
- Buildings

There are doubtless other things, but those are the ones that were relevant during this storm. This is not a complete plan. **We should, as a community, develop a storm preparation plan for the harbour.**

Prior to the storm there was some amount of preparation. It consisted mainly of checking boats on moorings to see that nothing was obviously wrong, and tending to the shared pontoon. This is good but it is not enough.

In particular, the harbour was half empty as the Royals had lifted out the previous week. Boats were clustered together (near Figure 1Y). The boats should have been spread as widely as possible to minimise damage from collisions in case of dragging.

The effort to rescue *Hale Kai* and *Bella* required a support vessel. It is a question of judgement whether to use the support vessel, but if it is not available we cannot even ask the question. Even discounting such an operation, if someone had fallen into the harbour (perhaps one of the maniacs that were surfing off of the breakwater at certain points in the storm) they would need to be rescued. We have twice in recent times pulled people from the harbour using club boats, once with a child in the water where the Coast Guard attended without a support vessel. There are about five club-owned launches of varying capabilities. Only two were available after the gantry leading to the Royal pontoon collapsed. We need to maximise the availability of support vessels, ready to be used if required.

We were unexpectedly host to two fishing boats that sought shelter. They had inadequate lines. Their lines were frequently breaking. The lines of some local boats on the shared pontoon were frequently breaking. Whilst it is the responsibility of the masters of vessels to have had adequate lines, sometimes they do not. The choice then is to allow them to break free and

do more damage, or to secure them. We should obviously be reasonably prepared to secure vessels when needed. This means we need to have coils of rope available. Similarly, fender material to prevent damage.

In case of a vessel sinking, especially if it is sinking in an inconvenient or unsafe spot, we should be ready to use the salvage pumps. We have at least two readily available, but people need to be aware of this and know how to use them. Awareness and coordination leads to the next recommendation.

7.2 Organisation and communication

Whilst we need to organise and communicate in order to plan and prepare, this is very different from operational organisation and communication during a storm or other kind of crisis. Fortunately, as mariners, the difference is easy to understand. We mount watches at sea, maintain situational awareness, and act to prevent, mitigate, or respond to circumstances that arise. It is the same for a harbour. **We should, as a community, organise a harbour watch during major events.**

We have two buildings, with different views of the harbour. They have kitchens, places to sit and rest, toilet facilities, and so fourth. At least one has a radio. Either the Royal bar or the Corinthian Bell Block are suitable places to run an operations centre. They should both be open with people present, keeping watch, both visual and radio, throughout the storm.

This way, fishing boats that are taking on water can ask for help, and we can organise help. That way, if people go out to rescue someone from the water, or to move a vessel out of danger or prevent damage, there is awareness of what is happening in the harbour. If necessary, emergency services or similar can be also made aware in case they are needed.

It is important to maintain a radio watch specifically. Channels need to be organised in advance. A watch on the calling channel, 16, should generally be maintained. A watch on the local VTS channel, 71, should generally be maintained. A harbour channel should be established and a watch maintained, this will require a shore station license which is easily obtained (which specific organisation holds it is a details). This might require several radios or radios with a 3 channel watch capability, and people need to know how to operate them.

It is equally important that these arrangements are not limited to the two yacht clubs. Seahunter Marine maintained a watch on-board during the storm. Communication with them would have been a good idea. Those users of the harbour who are not members of yacht clubs should feel welcome. The door should be open.

8 ON RISK

Acting under uncertainty and evaluating risk is difficult. Different people can tolerate different degrees of risk. They may evaluate the riskiness of an action differently according to their perception of the situation, their own abilities, and the abilities of others involved. The risk of taking an action needs to be weighed against the cost of not taking it.

For somebody who has a production sailing yacht that they use for races or short cruises in the evening and the occasional summer holiday, it is perhaps defensible to leave it to fend for itself in a storm provided that reasonable efforts were made beforehand to secure it so that it is not a hazard to others. If something goes wrong, insurance will replace it and it is no great loss. For somebody whose sailing yacht is their home or their livelihood, the calculation is very different. For them it is not a mere toy or plaything. The cost of loss is greater. They

tend to be underinsured because the value is much harder to quantify.

Consider *Hale Kai* as a case study. The vessel was purchased for £11,500 some years ago and is still insured for that amount. Many hundreds, probably thousands of hours have been put into a major refit. Its intended use is not leisure but as a long-term home – a house on land and a comfortable retirement, let alone a recreational yacht on top of that, is out of reach on an academic salary nowadays. It is also a platform for scientific research. There are three active projects that involve it: developing inexpensive low-carbon propulsion systems that can be retrofitted onto sailing yachts, low-power decentralised radio systems for exchanging situational awareness information about conditions and hazards, and environmental sensing systems that can easily be deployed on sailing yachts for research¹. All of this means that the cost of the loss of *Hale Kai* would be well in excess of the insurance value. It would be years of work and a major setback to my livelihood. To simply watch her be smashed against the *Shearwater* when it was possible to do something is unthinkable.

The question is then *how much* risk is acceptable. It comes down to a judgement call that can only be made in the moment. The first thing is to not leave the scene before the vessel is actually lost. Do not give up while there is still at least a possibility of saving it.

I had total confidence in *Hale Kai*. In the pathological conditions near low water in the harbour, she tended to point into the waves rather than into the wind. This has to do with her underwater profile: a long keel and two bilge plates. Her motion in a seaway, certainly compared to the smaller boats in the harbour, is kindly. It is truly remarkable how stable a heavy cruising yacht is. This is a vessel that, when caught out by the Fastnet storm crossing the Bay of Biscay, lay ahull in 10m seas, was knocked down twice, and came out unscathed. I had reinforced weak points during the refit and installed new rigging. I have had *Hale Kai* out in 3m seas under sail and under engine. I had recently rebuilt the somewhat overpowered 35bhp engine. Conditions near high water in the harbour were nothing in comparison, provided I could get aboard and keep her away from obstructions and other boats. Similar reasoning applies to *Bella*, a 10 ton steel boat built like a tank.

The risky part was getting aboard. Once aboard, we could stay there indefinitely in safety. The risk could have been lowered with organised shore support (see above). As it was, for the first rescue of *Bella* and *Hale Kai* (Sections 5.3.8 and 5.3.9) we had ad-hoc shore support which proved sufficient. The operation to rescue *Bella* the second time (Section 5.4.1) did not have shore support. I was not present and have little doubt that it was accurately judged in the moment, but there was little awareness by others in the harbour of what was happening and no plans for rescue if it had gone wrong. It could have easily gone very wrong.

9 COMMUNITY DISASTER RESPONSE

Much of my thinking during Storm Babet and afterwards when reflecting on what we can do to reduce our vulnerability is

coloured by my experience in disaster response. After Hurricane Katrina hit the US gulf coast in 2005, I was part of the ad-hoc community response that developed when it became clear that the government and institutional response was far too slow and unaware of reality on the ground. I learned of the importance of talking to the directly affected people, finding out what help they needed, and trying to make that happen. I learned about organising open, inclusive, community based operations centres to maintain awareness of what resources we had, what was needed, and who was doing what. This works much more effectively than reporting up a hierarchical command structure, waiting for decisions to be made by people standing at a distance, and then following what orders might follow. We moved food, cleaning and medical supplies to where they were needed. We organised an evacuation and shelter when a second hurricane, Rita, followed a short time later. It was a drop in the ocean, but we were able to make a positive difference. There was a similar pattern after the 2010 earthquake in Haiti and in the early days of the COVID-19 pandemic.

I consider Storm Babet in Granton Harbour to be a minor natural disaster. Just because it is in some sense “natural” does not mean that there is nothing we can do to prepare and mitigate its impact. We can and must organise to compensate for our harbour community’s vulnerability to increasingly early, frequent, and intense storms. This organising must be open and inclusive of all community members. Social barriers must come down. We have an enormous amount of capacity and variety of skills and abilities in our community and everyone has something to contribute. Situations will arise during a weather event. Our response cannot end when the weather rises and resume when it passes. We need, at the very least, to maintain awareness of what is happening and, if there is any potential danger, who is involved, what the plan is, and what the backup plan is. The usual organisational structures are not well-suited for disaster operations and need to take a back seat.

Fortunately, as seafarers, we already have a very good conceptual framework for managing operations in both routine and extreme circumstances. Humans are land animals. We do not swim very well. The systems we have developed to make seafaring possible serve us very well. We do watches at sea. When the need arises, we can do watches in the harbour. We are all in the same boat.

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1. For clarity, this does not mean that *Hale Kai* is in commercial use, just as if one works from home, one’s house is not in commercial use. But it is difficult to work from home without a home. In no circumstance does *Hale Kai* perform work for hire or accept payment for services.