

DISPROPORTIONATE

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TRACKING FERRY SAFETY IN
THE SOUTHERN HEMISPHERE

BY ROBERTA WEISBROD



A car ferry crosses the Bay of All Saints toward Itaparica Island. Brazil has had relatively few accidents and few fatalities compared with other nations in the Southern Hemisphere.



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The Southern Hemisphere, which is mostly ocean, has a disproportionate percentage of ferry accidents for its population. Our purpose here will be to look at the patterns of ferry accidents, and to examine underlying causes and potential solutions.

Approximately 80% of the surface of the Southern Hemisphere is ocean. The continent of Antarctica accounts for a significant portion of the land; the remaining habitable area is actually just 16% of the surface of the hemisphere. Some 800 million people live in the Southern Hemisphere, approximately 12% of the global population. More than half of the hemisphere's population is in two of the top five most populated nations in the world: Indonesia (population 263 million) and Brazil (209 million). (China, India, and the United States are numbers 1, 2, and 3). Australia, New Zealand, and Tasmania together have approximately 30 million and Papua New Guinea adds another 8 million. Aside from Papua New Guinea, the total population of the Pacific islands is approx-

The islands of the South Pacific are widely scattered, and African nations in the Southern Hemisphere are physically isolated by the Sahara.

imately 3.2 million. The population of African nations that lives below the equator—close to 300 million—completes the rest of the hemisphere's population.

Compared to the Northern Hemisphere, people in the Southern Hemisphere are isolated from each other and from the North. The islands of the South Pacific are widely scattered, and African nations in the Southern Hemisphere are physically isolated by the Sahara. Until recently, there were no direct flights from North America to the region. Australia and New Zealand are far from the Western Hemisphere, from Africa, and from much of Asia. South America's degree of isolation is related to the language barrier with the North.

For various reasons—physical isolation, language, and global north self-regard—there is not a steady stream of news from the hemisphere. Quite the opposite, in fact: information doesn't come. It has to be sought.

Weather and climate

The World Meteorological Organization (WMO) describes recent weather in the Southern Hemisphere as extreme. For example, in the first quarter of 2019, WMO reported that, "Australia, southern Africa and eastern Brazil saw very dry conditions. Madagascar

and northern Argentina saw much wetter than average conditions. The latter was severely affected by flooding."

More critically, what seemed like a series of anecdotal reports in the Worldwide Ferry Safety Association (WFSA) ferry safety database, particularly increasing reports of sudden big waves, has been confirmed in a *Nature Communications* report published in January 2019. Entitled, "A recent increase in global wave power as a consequence of oceanic warming" the report documented that waves, especially in the Southern Hemisphere, are indeed getting much higher and stronger.

By the numbers

Based on the Worldwide Ferry Safety Association's database, between 2000 and the end of 2018, a little more than 30% of all fatalities, and almost 32% of all accidents, occurred in the Southern Hemisphere. With a population of 800 million people, and only 12% of the global population, these are disproportionate statistics. Specifically, during that period there were 91 accidents and 7,029 fatalities. During the same period globally, there were 284 ferry accidents with 21,996 fatalities.

About data collection: there are no international governmental organizations that track formal national government statistics about ferry accidents. WFSA has been keeping track of media reports on ferry fatalities that have occurred since 2000. (Dr. Neil Baird recently began collecting data on ferry fatalities over a longer time period; WFSA and Baird periodically exchange data sets). Given that virtually the only information available is through media reports, with almost no official investigative reports, there are numerous limitations. Sometimes, the causes of incidents are not presented in the media, and worse, on occasion vessel names haven't been entered, so that followup is impossible. Reports often list the number of missing, but based on experience, it is extremely rare that missing passengers are found, so in this database the dead and missing are listed together.

Analysis of fatal ferry accidents between 2000 and 2014, as reported by WFSA in the *Journal of Public Transport* in 2016, indicated that the causes of fatal accidents were due to human error in 75%-92% of the accidents, with the range a function of how human error is defined; weather 53%; overcrowding/overloading 29%; navigational issues (collisions and grounding) 22%; and fire and engine problems 11%. Note that the causes add up to more than 100% because multiple causes are responsible for fatal ferry accidents. These causes occur in Southern Hemisphere ferry fatalities, but in different permutations.

What is the cause of the Southern Hemisphere's disproportionately high share of accidents—32% of both fatalities and accidents—compared to the world as a whole? Two issues stand out. The weather across the wide fetch of ocean can be vicious (and is getting more so). In addition, the tools that could be employed to detect and communicate the problem have been weak. There has been a lack of coverage by

In 2012, *M/V Skagit*, a former Washington State ferry, capsized and sank off the coast of Tanzania while enroute to Zanzibar.

satellites and automatic identification systems (AIS), which compounds the problem of vicious weather. The lack of satellite coverage in the equatorial region, that is, plus or minus 20 latitude across the Indo-Pacific Ocean, has hampered ocean weather and wave prediction and communication of same. Also, in the event of accidents, it hampers the communication needed to marshal lifesaving efforts.

Better tools

Innovative tools will soon provide satellite coverage for the equatorial ocean area. Before the end of 2019, U.K.-based Aerial Maritime will launch swarms of shoebox-size nano-satellites, which will offer affordable platforms to provide significantly increased maritime situational awareness. When equipped with appropriate instruments, nano-satellites can provide position reporting, capture weather data, and relay weather data and other messages. Their relative inexpensiveness is due to their including a number of components that originate from the mobile/smart phone sector, and therefore benefit from the production volume from that sector.

The physically small units can be packed in higher numbers on rockets, meaning the launch cost also comes down. The overall effect is cheaper systems, which in turn means cheaper data. Nano-satellite technology therefore opens a cost-effective window of opportunities not offered by traditional satellites.

AIS was mandated by the International Maritime Organization (IMO) for most vessels, including ferries, to take effect in 2008. The IMO left it to the individual nations to regulate and enforce. AIS requires high frequency radio antennas on land and transceivers on vessels. The Southern Hemisphere nations have a shortage of antennas and thus lack the ability to track vessels that could be heading into danger, and to find them after landing in dangerous situations. David Hewson, of Vesseltracker, has documented the location of antennas in the Southern Hemisphere (see table 1).

AIS may not be cost prohibitive for ferry operations. A commercial service will provide free antennas and free AIS data reports to public and or private landowners who commit to maintaining the antennas. Several organizations, including WFSA, which is engaged in project development, have a goal of making the cost of transceivers for ferries and small vessels more affordable than they currently are.

Geographical distribution and causes

The nations with the highest number of accidents and fatalities are Indonesia, Tanzania, and the Democratic Republic of Congo. Indonesia has the highest number and percentage of accidents and fatalities in the Southern Hemisphere, with more 50% of the accidents (49/91) and 44% of the fatalities (3,071/7,029).

Ensuring maritime safety in Indonesia is a tremendous challenge because of the nation's size, layout, and weather. It is a nation of 17,000 islands, plus or minus 1,000, of which 6,000



Table 1: Number and Placement of AIS Antennas in the Southern Hemisphere

Nation	Number of antennas
Australia	124
Brazil	53
New Zealand	33
Indonesia	25
South Africa	22
Chile	16
Argentina	11
Angola	8
Mozambique	8
Ecuador	7
Peru	6
Paraguay	5
Namibia	4
Mauritius	4
Saint Helena	3
Tanzania	3
Madagascar	3
Fiji	2
Kenya	2
Uruguay	2
Réunion	2
Congo	2
Vanuatu	1
New Calendoncia	1
Somalia	1
Papua New Guinea	1
Gabon	1
The Maldives	1
Total	351

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are inhabited. It has the world's third longest coastline, at 33,939 miles, after Canada and Norway whose shorelines include the arctic latitudes. The shoreline extent of Indonesia is nearly three times that of the U.S. shoreline of 12,380 miles. Indonesia spreads out across a swath of the Pacific Ocean, 3,275 miles from east to west and 1,375 miles from north to south.

Analysis of Indonesia's 49 accidents and 3,071 fatalities between 2000 and 2018 indicates that more of the fatalities were clustered in the earlier years of the counting period. Of the known causations, there were 12 overcrowding and/or over loading of cargo, also clustered in the early years. Weather has been a constant causation, listed in 24 of the 49 accidents of which 11 were ascribed to big waves—more so in the recent decade.

There has been a lack of coverage by satellites and automatic identification systems (AIS), which compounds the problem of vicious weather.

There were seven fires on RoPax vessels, also more in the recent decade. (RoPax vessels are passenger ferries carrying truck, or roll-on/roll-off freight). This is an area of growing international concern for RoPax ferries, as well as container ships. Based on presentations at the recent Ferry Safety and Technology Conference by practitioners from China, the European Union, and Indonesia, the major causes of RoPax fires were hazardous materials in the trailers/containers. The causes of subsequent fatalities were related to failure to suppress fire, which has both training and vessel configuration aspects; with failing ability to suppress, the lack of safe egress accounts for fatalities.

Africa is growing in population and importance. The continent is expected to be the next big powerhouse for manufacturing. Broadband coverage will dramatically

increase, spurring more development. Of the 10 largest cities in the world in 2100, five will be in Africa, of which one, Dar Es Salaam, the capital of Tanzania, is in the Southern Hemisphere. In fact, it will be the third most populated city in Africa after Lagos and Kinshasa.

Tanzania has had a disproportionate number of accidents and fatalities—9 accidents and 1,981 fatalities. Tanzania's relatively small population of 57 million, which is 7% of the Southern Hemisphere's total, experienced 10% of the hemisphere's accidents and 28% of its fatalities.

There are three kinds of ferry systems in Tanzania. There are ferries that go between mainland Tanzania, often from the capital, Dar Es Salaam, to Indian Ocean islands including Zanzibar; there are the ferries of Lake Victoria; and there are river ferries. All three types have been involved in accidents. Of the nine accidents, all involved capsizing. Two accidents took place on rivers, two on the Indian Ocean, and five on Lake Victoria. Of the 1,981 fatalities, 1,573 occurred in one accident on the Indian Ocean, on the vessel *Spice Islander 1*, in 2011. For each accident there were multiple causes: engine failure, overcrowding/overloading, and weather. The most recent accident was in 2018, in which 227 people perished in Lake Victoria.

There have been numerous ferry accidents on Lake Victoria, at least 9 since the year 2000. Lake Victoria is the largest lake in Africa and is prey to ever-increasing violent storms, killing 3,000 to 5,000 fishermen annually, fishing being a main source of income. The lake has actually become a global hotspot for vicious thunderstorms, according to a report in 2016 in *Nature Communications* entitled, "Hazardous thunderstorm intensification over Lake Victoria."

Lake Victoria is surrounded by Tanzania, Kenya, and Uganda. Of the nine fatal ferry accidents, five were on the Tanzania side, three on the Uganda side, and one in Kenya. A report in *Africa News* in September 2018 stated that, since 2000, there had been a dozen fatal ferry accidents on Lake Victoria with high casualties; however, our database lists only nine.

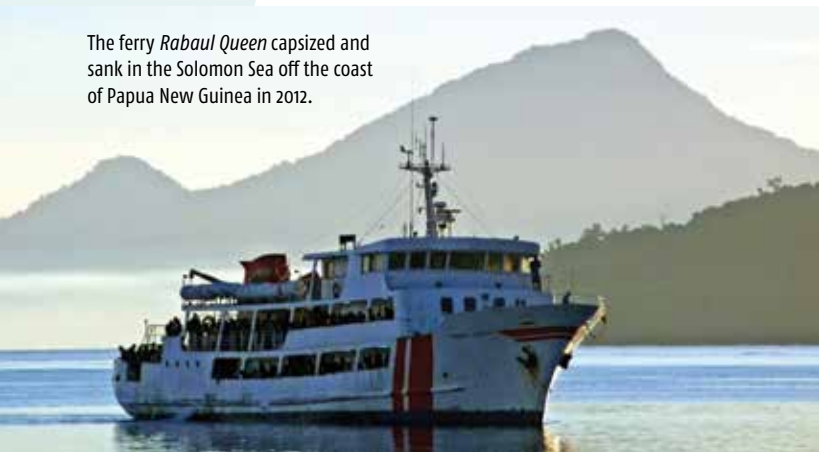
The Democratic Republic of the Congo had 11 accidents and 1,307 fatalities. The most recent occurred in April of this year on Lake Kivu, resulting in 150 fatalities. There were two fires; a collision of a river ferry at night with no lights; a grounding on a river sandbar and subsequent capsizing; at least three overloading accidents; and two with bad weather, one of which was on Lake Tanganyika, the site of two other accidents. Lakes were the venue for another three accidents. The data are incomplete.

In addition to Tanzania, Kenya, Uganda, and the Democratic Republic of the Congo, other African nations that had fatal ferry accidents were Rwanda with 12 fatalities, Zambia with 80 fatalities, and Burundi with 109 fatalities.

South America

Brazil is the other large and important nation in the Southern Hemisphere. It had relatively few accidents and few fatalities.

The ferry *Rabaul Queen* capsized and sank in the Solomon Sea off the coast of Papua New Guinea in 2012.



With 26% of the Southern Hemisphere's population, it has had 3% of the fatalities, according to our records.

Waterborne transport of people (and freight) is on the Amazon River system and from ports on the Atlantic Coast, the length of which is 4,650 miles. The Amazon River is impressive. It is approximately 4,000 miles in length and therefore is roughly equivalent to the length of the Nile at 4,083 miles, the world's two longest rivers. By volume of water flow, the Amazon River sounds like hyperbole. It is estimated that approximately one-fifth of all the water that runs off the Earth's surface is carried by the Amazon. At flood, the river carries four times the amount of volume carried by the Congo and ten times that of the Mississippi. Its fresh water flow can be observed 100 miles into the Atlantic Ocean. Its flow is some 80 times that of the Nile, and five times higher than the next highest volume river, the Congo.

There are reports in the international press of relatively few accidents in Brazil: 5 accidents for a total of 229 fatalities. One accident occurred in 2003, a capsizing in which 15 people died. Of the two accidents that occurred in 2008, both were on river systems, and the causes were collision in one



A map of the African continent shows the nations that are part of the Southern Hemisphere (those that are south of the red line of the equator).

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A ferry prepares to land in Kenya's Mombasa Harbor.

and a combination of not-fit-for-service vessels, overcrowded vessels, and bad weather (rainstorm) in the other. Of the two accidents in 2017, the causes of both were unclear. One ferry accident took place at night on a river, and the other enroute to islands off the Atlantic coastal city of Salvador in Bahia.

To learn more about ferry safety in Brazil, see "Brazil's Maritime Sector," beginning on page 16 in this issue.

Of the other South American ferry fatalities, there were 2 accidents in Peru, with 47 fatalities, and one in Columbia with 37 fatalities.

Oceania

There were a total of 249 fatalities in 4 accidents. There were 4 fatalities in Australia, 110 in Papua New Guinea, 62 in Tonga, and 116 in Kiribati (2 accidents). Australia has a population of 25 million, New Zealand has 5 million, New Guinea has 8 million, and the Pacific Island nations in the Southern Hemisphere have 3.2 million.

In 2018, Kiribati had a particularly horrendous accident in which 81 people perished, including many school children. Like other island nations in the Pacific, Kiribati is actually an archipelago of many islands. The Kiribati islands transcend the equator and the international dateline so that the nation is actually in the northern, eastern, western, and Southern Hemispheres. It is one of the most densely populated places on Earth and is highly threatened by sea level rise. The nation is part of the Pacific Community, which is an information sharing and coordination regional network.

The accident occurred on a small wooden ferry and was caused by unknown factors. It is known that the ferry, M/V *Butiraoti*, was clearly inadequate for distant inter-island ocean transport. Perhaps the most tragic factor was the lack

of communication with anyone who could provide timely help. As a result, lives that could have been saved were lost. Perhaps use of the new satellite systems will change that.

On search and rescue

Although the Oceania region had a relatively small number of accidents, it had a huge number of search and rescue (SAR) incidents. According to the June 2018 issue of *Pacific Community* newsletter, "Between 2015 and 2017 there were a total of 1,076 maritime search and rescue (SAR) incidents reported in Guam, Papua New Guinea, the Solomon Islands, Kiribati, Cook Islands and Tuvalu, an exponential amount for a region of our size."

The International Maritime Rescue Federation commissioned a report, made in collaboration with the WFSA, to analyze the nature and efficacy of SAR response related to fatal ferry accidents in the WFSA database. The 2015 report, "Ferry Accidents: The Challenge of Rescue 2000-2015" by Kirsten Reid-Sander, also looked at the SAR capabilities of each of the nations in which fatal ferry accidents occurred. A key commonality was the lack of adequate communications and vessel tracking. The new nano-satellites and implementation of AIS will go far in helping to prevent ferry and other maritime fatalities and to improve response.

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Roberta Weisbrod, Ph.D. is executive director of the Worldwide Ferry Safety Association.

The WFSA

Along with keeping statistics, the Worldwide Ferry Safety Association conducts an annual design competition for a safe affordable ferry for various ferry systems. Two of the six ferry systems recently designed for were in the Southern Hemisphere—for Papua New Guinea and for Indonesia. An official or ferry operator in the region is asked to make the specifications for the vessel and to act as judge. Judges have stayed on to judge other competitions and also have served as advisors. In addition, the WFSA commissions students to write papers on selected topics. The WFSA also convenes an annual Ferry Safety and Technology conference and highlights issues, such as weather and communication technology, which are directly relevant to the Southern Hemisphere. To learn more, check out www.ferrysafety.org