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Keepers of the flame

"If you're bored in statistics it's your fault," says NZIMA Maclaurin Fellow Professor David Brillinger; "there are so many wonderful problems out there to work on." He talked with Jenny Rankine.

He uses 250-year-old Newtonian mechanics to analyse trajectories, curves of object movement that are a common type of data. He calls his field random process data analysis: "random means probability is attached; process means evolving in space and time. I enjoy taking that maths and applying it to a soccer ball on the field, whale sharks across the ocean, elk in Oregon. I have a lot of fun interacting with scientists in the field."

Brillinger, who is Canadian, has maintained New Zealand connections from his first visit in 1976 to work on earthquake risk, a field where "New Zealand has some very good statisticians". His son lived here for a time and he visited his grandchildren regularly. One of his Berkeley students, Ross Ihaka, returned to New Zealand and developed the statistical analysis package R*, and Brillinger says he tends "to look after Kiwi students I encounter visiting Berkeley".

He started his work on animal movement, using data from marine biologists about how much time elephant seals spent diving, how deep, and where they swam. From this he developed models of seal movements, and helped deduce how they might be navigating.

Then he moved up to whale sharks, also tagged with GPS units. Like whales, these sharks eat phytoplankton, tiny algae. Brillinger compared shark movements with data on winds, currents, and chlorophyll density to associate their travel with algal blooms and strong currents.

His next project was a space analysis for NASA, which wanted a review of their estimates about the risk of debris damaging the international space station and the space shuttle. Astronomers had used radar to scan the sky and provide data on the size distributions of debris orbiting the earth. Brillinger's results were used to design the space station shields to withstand most predicted impacts.

"We have to make approximations because we don't get exact results very often; I'm concerned about how good these approximations are in practice. For example, a whale shark will be swimming continuously but we will only have data every three hours."

"The sort of statistics I do means I can look at something in one field, abstract it and apply it to other fields. Those space station results can be used with trajectories of other objects. Statisticians are often the ones who transfer information from one field to another," he says; "something learnt from biology might be passed onto engineering."

"Statisticians are the keepers of the scientific method," Brillinger asserts. "We say whether the scientists can reasonably draw that conclusion from the data they have. We do both exploratory and confirmatory data analysis, so we lose very few arguments. Scientists have to make assumptions, but we ask why should we believe that assumption? We also have to teach our students how to respond to that criticism of their work!"

* See IMAges 3.

Top: Elephant seals such as this male, female and pup have been tagged and their migration tracked across the Pacific. Brillinger's analyses have helped pinpoint how they and other animals navigate and behave at sea. Photo: Mila Zinkova, Wikimedia Commons.