

Of leatherbacks and lion's manes

by Lucas Brotz



Lucas Brotz (right) helps DFO crew aboard the CCGS W.E. Ricker sort the catch of the day: juvenile salmon and lion's mane jellyfish.

I study jellyfish, so you can imagine my surprise when I received an e-mail last year from a recovery planner for the Canadian Species at Risk Act (SARA). I am certainly not aware of any jellyfish in the world that is classified as threatened or endangered, let alone in Canadian waters where we know very little about our gelatinous fauna! On the contrary to being at risk, many jellyfish are in fact increasing in coastal ecosystems around the world. However, the subject of the recovery plan in question was not jellyfish at all, but rather the leatherback sea turtle (*Dermochelys coriacea*). What did I know about reptiles? Well, not much, but I was aware of one fact about leatherbacks: they are known to

eat jellyfish. The reasons behind the e-mail were starting to materialize, and I was intrigued.

As their name suggests, leatherbacks do not have a hard shell like the other six species of sea turtles alive today. Rather, their shell consists of smooth, leathery skin with seven ridges running its length. Such reptiles first appeared in the fossil record about 100 million years ago when their family branched off from other hard-shelled turtles, underlining the fact that these are truly ancient mariners. Leatherbacks are massive creatures. They frequently grow to hundreds of kilograms and can potentially surpass a tonne. From tip to

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tail the largest exceed three meters, with their flippers spanning more than four meters.

The leatherback's list of superlatives is nearly as large as the animals themselves! Among reptiles they are the fastest growing, fastest moving, and except for a few crocodiles, the heaviest. They are also among the most widely distributed animals in the world, mainly due to migrations that put all but a few marine mammals and bird species to shame. Surprisingly, they are also warm-blooded, and are therefore able to survive in environments far beyond the reach of their cold-blooded relatives. Believe it or not, leatherbacks have been sighted north of the Arctic Circle! To top this off, leatherbacks have been recorded diving deeper than a kilometer, plunging further into the abyss than almost all other air-breathers.

But perhaps the most astounding fact about this fascinating species (although I will admit, I am biased) is that leatherbacks can grow so large, travel so far and dive so deep on a diet consisting almost exclusively of jellyfish!

Why is this surprising? Jellyfish are roughly 95% water, therefore obtaining sufficient nutrition from them requires some serious feasting. A leatherback can consume hundreds of kilograms of jellyfish in a single day, which not only appears to supply all of their energetic demands, but also allows them to fatten up for return migrations to breeding

areas. Part of the success of such a strategy relies on the fact that jellyfish often occur in dense aggregations known as blooms. In addition, jellyfish have virtually no escape response, especially from an animal as fast and maneuverable as a sea turtle. Therefore, locating dense blooms of jellies is likely key for leatherback feeding success and appears to be the sole reason why they embark on vast migrations from breeding areas in the tropics to more temperate areas, including Canadian waters.

So now you can understand why someone who studies jellyfish would receive an e-mail about endangered sea turtles. And endangered they are. While there are a number of reasons for optimism regarding leatherbacks in the Atlantic, the Pacific populations appear to be on an alarming trajectory. Their numbers are uncertain, but it is estimated that there are fewer than 3,000 nesting females left – a precipitous crash of more than 97% in only a few decades. Numbers continue to decline, and Pacific leatherbacks appear dangerously close to extinction.

As one might imagine, sightings of leatherbacks in Canadian Pacific waters are relatively rare, averaging only about one per year. While that is not a lot, members of the population *do* visit here. And in order to survive unthinkable migrations from remote breeding sites in Indonesia and the Solomon Islands, those turtles visiting Canada's west coast are likely the largest and heartiest of the population. Therefore helping or saving just a few of these individuals could be crucial for a subpopulation's survival. The areas used by leatherbacks to feed on jellyfish blooms in British Columbia represent critical habitat,

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The *Sea Around Us* Project website can be accessed at www.seaaroundus.org and contains up-to-date information on the Project.



The *Sea Around Us* Project is a scientific collaboration between the University of British Columbia and the Pew Environmental Group that began in July 1999. The Pew Environmental Group works around the world to establish pragmatic, science-based policies that protect our oceans, wild lands and climate. Pew also sponsors scientific research that sheds new light on the dimensions of and solutions to the problems facing the global marine environment.



with Department of Fisheries and Oceans (DFO) scientists and technicians.

Interestingly, most of the scientists I worked with are salmon specialists. This is mainly because salmon scientists possess one thing that pretty much all marine biologists and oceanographers covet: ship time. DFO crews conduct integrated ecosystem surveys several times

each year in the coastal waters of British Columbia and have implemented consistent sampling methods since 1998. These sustained, year-round surveys along repeat transects are a rarity in an age of funding cuts, and the resultant datasets provide a wealth of valuable information. In addition to collecting oceanographic data, these surveys involve tows using large trawl nets to collect and study juvenile salmon populations. The unwanted by-catch in these trawls can include large jellyfish. Properly identifying and monitoring these jellyfish catches could provide new and valuable insights into these organisms in our coastal waters. This information may also be indispensable, I believe, for understanding the relationship between critically endangered leatherbacks and their gelatinous prey.

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Dr Carl Safina, author of *Voyage of the Turtle*, poses with a giant, nesting leatherback (TOP). Lion's mane jellyfish (*Cyanea capillata*); Photo: Conor McCracken

but unfortunately we know relatively little about the jellyfish living in Canadian waters. Migrating leatherbacks are likely feasting on an abundance of large "true jellyfish" (class Scyphozoa), including lion's mane jellies (*Cyanea capillata*), sea nettles (*Chrysaora fuscescens*) and moon jellies (*Aurelia labiata*). In order to better understand the abundance and distribution of these species, I began working

All of the scientists I worked with recognized the importance of collecting such information, and together we developed a procedure that we hope will create a permanent record of all future jellyfish catch. While I was eager to convince those I collaborated with to gather as much data as possible, I had to keep in mind that jellyfish were not the focus of the surveys and any procedure too onerous was unlikely to be adopted. Therefore, the protocol was designed to minimize the effort required for jellyfish processing, while at the same time maximizing the amount of useful information collected. In addition, a step-wise approach to jellyfish monitoring was recommended, whereby scientists and technicians can collect a minimum amount of data on jellyfish if they are analysing other catch, or obtain more

detailed information if processing time allows. Thanks to this collaboration between DFO, SARA recovery planners and the Fisheries Centre, we should be able to rapidly increase our understanding of jellyfish in coastal waters in the coming years, as well as identify those regions that might be most important for foraging leatherbacks.

While eating jellyfish appears to have been a successful strategy for leatherbacks for millions of years, there are disadvantages to having a gelatinous diet in the contemporary world. Plastic debris, which now litters the oceans, often looks very much like jellyfish. Studies have found more than a third of examined leatherbacks have plastic in their intestines and the proportion for dead leatherbacks is double that. But perhaps the largest threat to leatherbacks is as a result of their trans-oceanic migrations between breeding and feeding areas. These epic journeys bring leatherbacks into repeated contact with the ocean's most fearsome predator – humans. Leatherbacks are frequently caught as unintended by-catch or become entangled in the miles of fishing gear that crisscross the oceans. Anything that prevents turtles, which are air-breathers, from reaching the surface will cause death in less than an hour. Compound these dangers with poaching for turtle meat and eggs, global warming and an overall lack of awareness about the problems, and you start to read the Pacific leatherback's epitaph.

I find it especially tragic to see such a charismatic animal that has survived for so long, pushed to the brink of extinction in only a few decades


An individual leatherback endures what seems like a life of hardship – swimming thousands of miles across oceans of hazards, only to have cold, stinging jellyfish for breakfast, lunch and dinner. As a species, leatherbacks have persevered through unimaginable times, including ice ages and major extinctions. In fact, they are often referred to as Earth's last dinosaur. But it seems that leatherbacks may have finally met their match during this era dominated by the human species. I find it especially tragic to see such a charismatic animal that has survived for so long pushed to the brink of extinction in only a few decades. I have yet to be lucky enough to look into the eyes of a wild Pacific leatherback, something I long to do. I only hope that such an experience will remain a possibility.



wild whales
b.c. cetacean sightings network

You can help!

If you see a jellyfish, on the beach or in the ocean, report it to the citizen-science database at www.jellywatch.org. And if you spot a sea turtle, you can help by reporting your sightings at www.wildwhales.org. Scientists depend on information from people like you in order to understand species distributions and develop recovery plans for species at risk.



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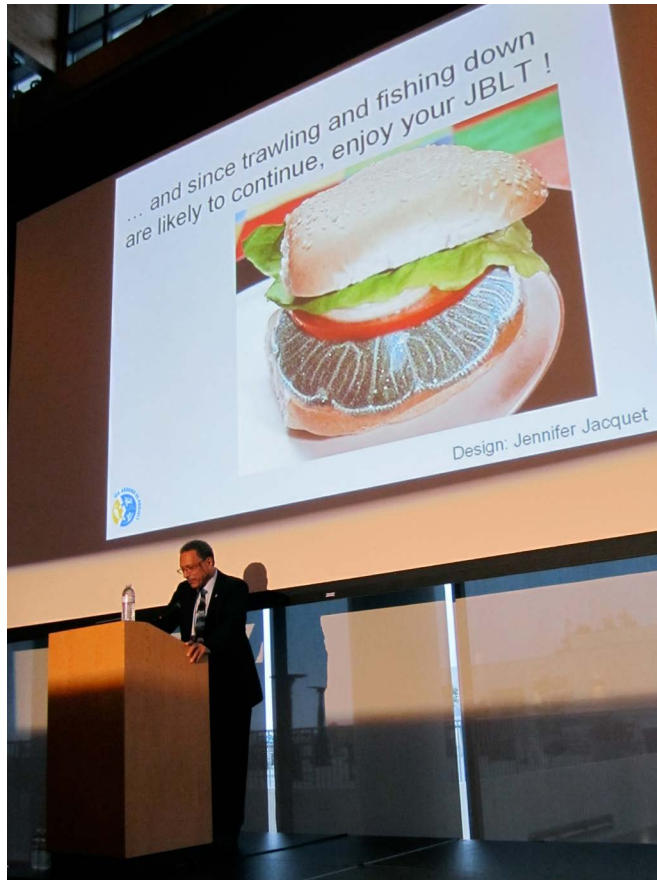
Igniting the public's interest in fisheries science

by Leah Biery

Dr Daniel Pauly joined the ranks of world-class storytellers including Jane Goodall, Walter Cronkite and David Attenborough during May 2012, when he was presented with the Nierenberg Prize for Science in the Public Interest at the Scripps Institution of Oceanography in San Diego, California. The prize, which honors the memory of underwater researcher, physicist and former Scripps Director William A. Nierenberg, is awarded annually to a person who has made outstanding contributions to awakening the public's interest in science throughout their career.

Guests at the event enjoyed the Southern California ocean breeze, hors d'oeuvres and live music at a rooftop reception, which was followed by the award presentation and an engaging public lecture given by Dr Pauly himself.

Nico Nierenberg, son of the late William Nierenberg, was joined by Scripps Institution of Oceanography Director Dr Tony Haymet in presenting Dr Pauly with the award. They highlighted some of Dr Pauly's major contributions to fisheries science, many of which have improved the way in which global fisheries are understood and managed today. As Principal Investigator of the *Sea Around Us* Project, Dr Pauly has revolutionized the online sharing of fisheries data by making information easily accessible to scientists and the general public through the *Sea Around Us* Project database and *FishBase*, an online encyclopedia of fish species that he co-founded. His efforts to document and publicize global fisheries trends in recent decades have greatly increased public awareness of declining fisheries and the importance of sustainable seafood initiatives. He was also recognized for acting as a leader in the international movement to protect marine ecosystems by expanding marine protected areas around the globe. Dr Pauly continues to share his message with the public through numerous publications in both academic and mainstream outlets, and through global travels to meet and converse with leaders and citizens around the world.



Dr Daniel Pauly helps his audience imagine the future of seafood if overfishing continues at its current pace. (Photo: Leah Biery)

Dr Pauly's lecture, titled "Jellyfish burgers, or how we changed the oceans and they changed us," served as a perfect example of his ability to pique the public's interest in ocean conservation. His talk addressed a variety of topics including shifting baselines, overfishing and declining catches, also outlining their implications for the future. Despite the seriousness of these issues, he maintained a sense of humor and received many laughs; using Dr Jennifer Jacquet's clever image of a jellyfish burger to help the audience imagine a future where it is the only seafood on the menu. Based on their reactions, it is safe to say that most listeners would be reluctant to trade their halibut sandwich for a "JBLT"! The lecture was followed by an enthusiastic round of applause and an interesting dialogue with the audience about current fisheries problems and how we might work together to solve them.

Congratulations, Dr Pauly!



Dr Pauly has revolutionized the online sharing of fisheries data by making information easily accessible to scientists and the general public

Rio: my experience

by Frédéric Le Manach



Fish sculptures made of plastic bottles, visible during the Rio+20 events at Praia de Botafogo. (Photo: Frédéric Le Manach)

Did you know that 50% of Bhutan is actually within protected areas?

During June I had the opportunity to go to Rio de Janeiro, Brazil, to participate in a panel on green accounting. It was organized as part of the 12th Biennial Conference of the International Society for Ecological Economics in support of the United Nations Conference on Sustainable Development, [Rio+20](#). This offer was extended to me based on my previous work on Malagasy fisheries for the World Bank.

Although my presentation was on a topic that many fisheries scientists deal with on a daily basis and find extremely delightful – fisheries accounting – it was quite disappointing. Indeed, only two panelists out of five (including me) were present. And because a plenary session involving Dr William Rees, who is also from UBC and part of the Fisheries Centre's associated faculty, and His Excellency Lyonchoen Jigmi Yoezer Thinley, Prime Minister of the Kingdom of Bhutan, was organized at the same time, attendance was low and the session short.

Thereafter, I quickly rejoined my colleagues to attend the second half of the plenary session and enjoyed learning about Bhutan. As Bhutan is a landlocked and relatively small state (smaller than the Netherlands), it is safe to assume that most fisheries scientists do not know much about it. For example, did you know that Bhutan is the first country to have dropped the very controversial yet ubiquitous gross domestic product (GDP) as a measure of living standard? In its place Bhutan has

adopted the Gross National Happiness (GNH) index, which it uses for policy making. If it fails the GNH test, so be it – next proposal. Perhaps as a result of this revolutionary stance, the country now benefits from free health care and education. Also, did you know that 50% of Bhutan is actually within protected areas? That its forests cover 80% of its surface? Or that the country is willing to become the first 100% organic country in the world? I found this talk enlightening and the highlight of the conference. (You can find out more in the document available [here](#).)

Bhutan was recently chosen to be part of the World Bank Group-facilitated 50:50 Campaign, in which 50 countries and 50 corporations are to fully implement natural capital accounting. Perhaps this will turn out to be a good way to promote Bhutan's work and convince other countries to adopt the GNH index.

During my stay in Rio, I managed to find some time to visit Rio+20 – at least some of the few events open to the public. Unfortunately, the conference centers were very far from the city center and it took about two hours to get there by bus. I was particularly looking forward to a session by a friend and colleague from Madagascar, who was presenting on family planning as a conservation tool, but the session was unfortunately cancelled due to the absence of any public but me!

Because I did not have any official accreditation, I did not see much more of Rio+20 than you did, and I followed most of it via internet. Although I did have the added excitement of being on location and seeing all the delegates running around like crazy in their fine suits! Overall, similarly to the Biennial Conference of the International Society for Ecological Economics, I was quite disappointed by Rio+20.

Ocean-wise, although the States "committed to think about dealing with" subsidies and the high seas, it is likely that nothing will be achieved before 2015, at which time they have decided to meet again to take action – hopefully. On a positive note, this is better than nothing, and at least these countries have not completely disregarded the oceans. Let's hope this is a positive omen for the future.

