Weekly Returns

by Suzi Claflin

By today's moral standards, the decisions of the past can be difficult to understand. All too often, they are abhorrent to our modern sensibilities. And yet, gallingly, the present inherits history's mistakes. Humanity's environmental legacy is a stark example; previous generations have laid the groundwork for the pollution and extinctions that are happening before our eyes.

Commercial whaling began in Australia in 1791 and continued well into the twentieth century, only stopping in 1979 in response to the threefold pressure of a growing conservation movement, a shrinking number of whales, and the emergence of synthetic replacements for whale oil. Over the course of its nearly two hundred year history, the Australian whaling industry took a significant toll on whale populations. By the 1960s, whaling had driven humpback whales to the brink of extinction, with only an estimated 800 individuals left in Australian waters.

Today, thanks to their protected status and an International Whaling Commission moratorium, humpback whales have made a strong comeback, multiplying their numbers nearly fortyfold to more than 30,000 individuals. It's tempting to end the story there, and close a nasty chapter of our history on an uplifting note. But it is not that simple. The future is uncertain for humpback whales, and the past still has more to teach us.

Weighty questions

Humpback whales undertake the longest migration of any mammal on earth. Australia happens to fall midway along their route. Every year these massive creatures glide through the shallower waters over the continental shelf, hugging the West Australian (WA) coastline as they journey 7,000 kilometers north from their summer feeding grounds in the Antarctic Ocean to the tropical waters of the Kimberley in order to breed. After the breeding season, they retrace their journey, travelling 7,000 kilometers back to the Antarctic. To add to the challenge, they fast throughout.

Though it's evident *why* they do it—to reproduce—it's not entirely clear *how* they do it. Enter marine biologist Lyn Irvine. Irvine is a PhD student at the University of Tasmania's Institute for Marine and Antarctic Studies, who is interested in just these questions.

Irvine wanted to understand the biological cost of migration. She wanted to focus on one component of the body in particular: fat. Fat serves a critical role in whale migration. It sustains the whales during the months when they are forced to forego eating. This makes fat a good measure of the stress of migration, and the demands it places on the whales. Humpback whales pack away as much fat as they can while in their feeding grounds, hoarding it for their epic journey north. Though most famous for their thick layer of blubber, humpbacks have caches of fat throughout their bodies, including in their bones and muscles.

Irvine was especially interested in the effect of migration on pregnant females, the whales carrying the greatest burden. In addition to swimming thousands of kilometers, they give birth to and feed a baby whale along the way. No small task. However, in order to understand how humpbacks sustain themselves during migration, Irvine and her collaborators needed fine-grain data about the body compositions of the whales. But historically these sorts of measurements were only possible once a whale was dead, so there was only one likely source: whaling records. Because they wanted to produce as much whale oil as possible—and thereby maximize profits—the whaling companies extracted all the oil they could from whale carcasses, making them reliable recorders of whale fat content. And, because this was a business with shareholders and bottom lines, they kept records of their catch.

Unfortunately, it seemed like the data Irvine needed didn't exist. From what the researchers could tell, the whaling companies had grouped the data, so that the individual-level information was lost in a sea of averages. Then, by chance, Irvine met a retired whaler. As they discussed their mutual interest in whales, he told her that the Cheynes Beach Whaling Station in WA *had* recorded just the sort of data she was looking for—detailed measurements of the fat content of individual whales. Because the station was so small, only catching 1-2 whales per day, they were able to record information for each whale they processed. They called these records the 'weekly returns'.

Irvine knew the Cheynes Beach weekly returns were the key to her research. Now she just had to find them.

A whale of a tale

The search took Irvine two years. She started at the JS Battye Library of West Australian History in Perth, WA. When that proved to be a dead end, she followed the trail abroad to the Sandefjord Museum in Norway, a museum dedicated to the whaling industry. After that, she tried the International Whaling Commission archives. From there, the trail returned to Australia. Irvine traced the path of the weekly returns as they were moved

between governmental departments, untangling fifty years of knotted red tape. Finally, she found them in the WA State Records Office in Perth. After two years, she ended her search in the building next door to where it started.

Thanks to generations of dedicated archivists, the records were in good condition. And immediately, Irvine found that they held a happy surprise: the humpbacks weren't the only whales the Cheynes Station recorded. The weekly returns also contained meticulous notes on sperm whales. This was a great stroke of luck, as sperm whales do not migrate, and instead feed all year long. The contrast between sperm and humpback whale natural history makes for a good comparison, shedding light on the different demands of the two survival strategies.

After locating the records, Irvine began the gruelling task of making the data usable. She leafed through the weekly returns wearing gloves to ensure the oil from her fingertips did not degrade the paper. She snapped photos of each page. Later, she painstakingly entered each piece of information into a computer spreadsheet. After all of that, the measurements were still in the imperial system, and had to be converted to metric.

Then, finally, her analysis could begin.

Learning from the past

Irvine found information for 3,000 individual whales. From the data, she was able to determine that pregnant females store the most fat of any humpback whale: 26.2% more than non-pregnant females and a staggering 37.4% more than males. The results clearly illustrate the enormous demands placed on pregnant females during their migration. The extremes they go to in order to make the journey leave female whales very vulnerable to changes in their food supply. If the populations of small fish and krill that they feed upon were to decline, female whales, which require the most fat to survive migration, would be the first to suffer.

The difference between humpback and the non-migratory sperm whales was even more stark. Humpbacks stored 31.9-74.9% more fat than sperm whales of similar body size. Whales that do not migrate can afford to have over a third less fat than those that do because they stay put and are constantly feeding.

Irvine's research makes it clear that to survive, humpback whales need more than a whaling moratorium. They need their feeding grounds to overflow. Without an abundance of food, the whales cannot store up the masses of fat

required to fuel them northward, where they mate to produce the next generation.

Looking to the future

If it's true that those who do not learn from the past are doomed to repeat it, then it behoves us to learn all we can from the ignoble pieces of our history, in order to protect the future from its failures. In that spirit, Irvine has extracted one more lesson from the dataset. She verified a non-invasive method for measuring whale body composition. It is now possible to determine the condition of a humpback whale with a simple photo. No harpoon required. This is an important step for the continued monitoring of humpback whales, allowing scientists to accurately determine how well the whales are faring without harming them or interfering.

Thanks to the diligence of corporations motivated by economic interests, Lyn Irvine has developed a dataset that is unique in its size and scope. Because of its detail, it is the only dataset of its kind anywhere in the world, making it invaluable for the study of humpback and sperm whales. It will help shed light on a variety of research questions, and aid scientists as they attempt to unravel the impacts of climate change on whale populations.

In her work, Irvine has done a kind of ecological alchemy. She has transformed a record of a species' near-destruction into a safeguard for its future.