Ep 3 Understanding the Health of Whales and Dolphins.mp3

[00:00:00] Thank you very much for joining us today and welcome to the Explorathon Lunch Bytes podcast, a chance for you to hear about some of the latest research projects coming from the University of Aberdeen while you enjoy your lunch break.

[00:00:14] Explorathon 2020 is a weeklong programme of events being brought to you by the University of Aberdeen and other Scottish universities as part of European Researchers' Night, which this year takes place on the 27th of November. European Researchers' Night is a Europe wide public event which tries to bring researchers closer to the public and this week, amongst other events, the University of Aberdeen is bringing you a daily podcast, giving you the opportunity to hear from some of our local researchers about their projects in a range of different disciplines. All events being run as part of the Explorathon 2020 programme can be found on the website at www.explorathon.co.uk and the programme is being funded by the European Union's Horizon 2020 Research and Innovation Programme under the Marie Skłodowska-Curie Actions Grants Agreement 955376. After listening to today's podcast, please let us know any comments or feedback by contacting us on Twitter or Facebook @ernscot or use the hashtag #explorathon20. You can also put any questions or comments to us by email, by contacting the university's Public Engagement with Research Unit at peru, and that's spelt P-E-R-U, @abdn.ac.uk.

[00:01:42] Most of us will be aware of the effort being put in to protect whales and dolphins. A key factor in conservation efforts is assessing their health and the impact things such as fishing, noise and other disruptors has. However, that is limited ways of measuring their health. Improving our understanding of their health, but ultimately ensure conservation and protection efforts has their intended effect. So with that in mind, I'm joined today by Dr. Davina Derous from the University of Aberdeen School of Biological Sciences, who's leading research into the health of these incredible mammals and seeking to find new measurements of health which will ultimately improve conservation efforts.

[00:02:27] Dr. Davina Derous, thank you for joining me. Hi thank you, I'm very excited to be here.

[00:02:33] It's great to have you. So you were initially involved in human nutrition, so tell me, how did you get involved in the research of the health of dolphins and whales?

[00:02:44] Yeah so during my PhD and postdoc I worked on healthy ageing and there's this one method that's been known for about 100 years to extend life and this is calorie restriction, and as a concept it's very easy so we eat less calories, you live longer and that's been shown in many, many different species. But essentially this is some kind of disruption to energy metabolism so that will trigger a certain starvation response and that will have an impact on health. So you'll know that during a starvation our fats are being used up because that's an energy store, but cetaceans, so cetaceans are dolphins and whales, have evolved many, many years ago to have this very, very thick layer of fat so that's known as blubber. And blubber is not only used for energy stores, but is also used for buoyancy, for example.

[00:03:35] And because of my background and in fat and energy metabolism, I was involved in projects to try to understand which mechanisms are regulated in dolphins and whales and this in response to what we call the disruptive foraging, so that means less food available, and specifically how their blubber metabolism might differ from what we call the classic mammalian view. So now I started my own research group and I decided to

use my expertise in energy metabolism as a backbone to unravel the way the cells of cetacean's function and how this may have changed through evolution and what the impact might be for their conservation.

[00:04:17] And so how have dolphins and whales evolved?

[00:04:21] Yeah so they're a really interesting species, so they underwent what we call a second adaptation to life in water so 50 million years ago. So at some point, these mammals basically were on land and decided - so making quotation marks in the air with my hands - so decided to go back into the sea and as you can imagine, this brought with it many, many evolutionary changes. And these changes were to their anatomy, physiology and metabolism and it's that change in metabolism I'm most interested in. And one of the key changes they have, as I mentioned before, is that thickening of their fat layer of blubber and this is to keep them warm, but also for buoyancy and for energy reserve.

[00:05:03] So if you look at the amount of fat they have, you could classify them as obese to human standards, at least. So, but they do not have the same negative effects of obesity that we would see in humans, but also in dogs and cows so basically other domesticated land mammals. And in addition as well, they do not develop diabetes in the same way as us humans do. So a part of my research in collaboration with Dr. Marius Wenzel, also at the University of Aberdeen, is comparing key bits of DNA between different species and then see how they have evolved and this can tell us a great many things about how we would expect a certain mechanism to work. And we found some really cool changes in those mechanisms that showed that cetaceans were able to adapt to a glucose poor diet, so that makes sense because they mostly eat fish, but also overcome negative effects caused by hypoxia during diving. Now hypoxia is a low state of oxygen so during diving there would be a low amount of oxygen available and that can cause damage to cells. So, mechanisms related to that were changed. Another thing we found, as well is that they modified the way they signal their fat stores. So because they have so much fat, they have changed the way they signal that compared to land mammals. And this is really, really important that we understand from a metabolism point of view how these animals may potentially react to different challenges in the ocean.

[00:06:35] And what are the challenges that are facing whale and dolphin populations?

[00:06:41] So I think the main one people are so focused on is plastic and yes plastic can cause all kinds of issues so from causing starvation to entanglement to suffocation and so on. But a big one as well is vessel noise and mass stranding, so that's when a large group strand on the coast, so mass stranding's that have occurred when naval activities are happening. But another one is tourism or even fishing. So bycatch that's, for example, when dolphins are entangled in fish nets, for example, by tuna fishing. So bycatch is also a big issue with smaller cetaceans. But also tourism can cause issues so, you know those tourist boats where people are on the boat and they're chasing the animals to take pictures and so on. So that can also cause stress or they can even move from a critical feeding ground.

[00:07:33] Another one to bring up as well is a change in climate and to give an example, so researchers have analysed data of the last 35 years of abundance and survival rate of fin whales in the subarctics, and they showed a negative trend in the population and also a decrease in observed calves being born so that's basically the calves that you physically see. So one of the likely drivers they mentioned for this is a change in environmental conditions. So, for example, the change in climate is affecting the amount of prey that's

available so that's a big one as well. And last one I will bring up is pollutants. So pollutants are interesting because most of these damaging chemicals were banned in the 1970s, yet they still show up in cetaceans these days and it can have massive impacts on their reproduction, survival and health. So all these different challenges are what we call stressors and what we face right now is we face a knowledge gap of how their metabolism is regulated and how these stressors are affecting this.

[00:08:42] So, for example, the vessel noise can cause the cetaceans to move away from a critical feeding ground, and that means they will have less food available to eat and they'll have to rely on their fat stores more. But it also means that they can invest less energy into production. So from an energy point of view, reproduction is one of those mechanisms that is very, very, very costly so if there's less energy available, that will have an impact on the amount of baby whales or dolphins being born. So we really need to understand how these stressors impact their health and just to understand the metabolic constraint, as we call it, that wild cetaceans might face. So monitoring their health is vital and this is so we can put policies in place to conserve these species.

[00:09:29] So what is currently done to assess the health of cetaceans?

[00:09:34] So in the wild health is currently assessed by measuring blubber thickness, so basically that's the amount of fat reserves they have so it's built on the same principle as in humans and other mammals. So, again, fat is this energy store so when an animal is starved, more of that storage will be used and this blubber thickness will be less. So I collaborate with the Scottish Marine Animal Stranding Scheme and they are based in Inverness and they measure blubber thickness as a part of a post-mortem examination of stranded cetaceans and these cetaceans die on the Scottish coastline. So they have data from the 1990s until now in several different species and we analysed all of that data and that showed that blubber thickness was actually very poorly linked to the end health analysis that stranding people do by the post-mortem examination. So we also recently wrote a review that focuses on blubber thickness and other researchers also found the same thing in wild animals, that blubber thickness was poorly linked to health. So this makes sense because blubber is a very complex tissue and as I mentioned before, it has evolved to serve several functions in addition to energy stores. So, again, for example, the buoyancy, but also the insulation to keep them warm, so to be able to maintain these processes of insulation and so on they need to maintain a certain level of fat for this.

[00:11:03] So you've mentioned that blubber potentially isn't the correct measure of health in these mammals, so what could be the alternative measures?

[00:11:11] Yeah so this is a very this is very complex as we are working with wild animals and often they can be hard to sample, but also that they are quite often don't appear to the surface. So the easiest tissue to sample is blubber because this can be sampled with what we call a dart biopsy and this can be taken from a distance on a boat as well. So with smaller cetaceans you're able to temporally constrain them and take blood, but this can be stressful. So really the best way forward in these animals is taking that blubber. So what can we use as an alternative measure to blubber thickness? Well I think we need to find novel health markers and I think we need to take a step back here and really focus on how these amazing animals work. So we have a vague idea of how their metabolism works and they do use up their fat stores, but we have a very little understanding of how blubber metabolism works and this will likely be different in a harbour porpoise, which is quite small compared to, for example, a blue whale. So, and this is where my work with people of the stranding scheme is so vital. So by looking at these stranded animals we can gather a

more detailed insight into their health as they are exposed to foraging challenges. So one of these could be, for example, an acute trauma where they died instantly by bycatch, but also infectious diseases so animals are starved, but also, for example, the mass stranding's. And also the great advantage is that in these stranded animals you can actually gather key organs involved in regulating stress and metabolism. So to give a few examples, this is the adrenal gland, muscle, fat and liver. So this is something that we can't do in free ranging animals. So we can create this whole and to create an integrative body physiology approach that will contribute to the knowledge we have of how energy stores is linked to health and this can all be done in the same animal. And then we can look at how all of this ties in with blubber and how this will translate with blubber in wild animals.

[00:13:19] So one of your current research interests is the impact on stressors on whales and dolphin's health. Can you tell me more about your work in that area?

[00:13:29] Yes so one of the projects I mentioned is working together with the stranding scheme in Scotland but sadly, due to covid, I haven't been able to analyse any of this data yet, but I will be soon so that's quite exciting. Another project I was a part of was analysing metabolomics data, so metabolomics are these really small molecules in the body as an end result of our metabolism so it gives us a snapshot of what's going on in the body. So I analysed metabolomics data from blood samples in wild bottlenose dolphins in Charleston, and this is South Carolina, and these animals underwent a health assessment to see how healthy they are and I linked their metabolic profile to their health state.

[00:14:11] And from any of your recent research projects, have you got any emerging findings from your work?

[00:14:18] Yeah so from the metabolomics profile I mentioned, so we found that the dolphins that showed signs of a disease or an illness actually had higher stress levels and the metabolic profile also showed that they might break down their muscles. So that means if these sick animals would be exposed to another stressor, such as a vessel noise, they might be able to less cope with this. So stress by these vessel noise would lead for them to be to trigger their fight and flight reaction, and that needs tremendous amount of energy so if they already are breaking down their muscles then it might be that compared to a healthy animal they might need, they might not be able to recover from this.

[00:15:04] And so what could your work mean for conservation? What could be put in place to support these mammals better?

[00:15:12] Yeah so we really have the urgent need to understand the impact of multiple stressors so these are the vessel noise, pollution, climate change and so on. So we need to understand the impact of multiple stressors on the health, how we can monitor their health so, for example, by finding novel markers and if we need to put policies in place to conserve these species. So, some species do not recover after protective policies have been implemented and I'll give you an example from the states so for the last three decades, America has put in implementations, so together with International Fishing Agency, that has reduced dolphin bycatch during fishing, tuna fishing. So they have reduced bycatch massively yet the population growth of dolphins does not seem to recover quite clearly. So it seems that we're not getting a clear picture of everything that's affecting their health and reproduction and what I'm trying to do is I'm trying to close that gap between how these stressors can affect stress, health and metabolism and also reproduction and many other mechanisms. So once we've got a really good grasp of this

we can start predicting how these species might react to certain stressors and we can also put better policies in place for their conservation. So if you know that a certain stressor, for example tourism, can cause more stress we can put more, for example, distancing in place or something like that. And a big part of this is finding those novel health markers and that really gives you an insight in what the body condition of the animal is. So although my work is focused on metabolism of dolphins and whales, it really is a part of trying to find those novel health markers that can be used in the wild to assess how healthy the population is and if they are impacted by stressors.

[00:17:02] So thanks very much, Davina, for a very interesting overview of your work with cetaceans. I wish you all the best with that work moving forward.

[00:17:11] Thank you. Always a pleasure to be here. Thank you, Rachel.

[00:17:15] We hope you enjoyed today's podcast, but for now, thanks for joining us and keep an eye out for our other Explorathon Lunch Bytes podcasts. As I said at the beginning, we love to get your comments and feedback, so please use the hashtag #explorathon20 or tag us on Twitter or Facebook @ernscot. You can also email the university's public engagement with research unit by emailing peru@abdn.ac.uk. If you're interested in finding out about the other events taking place as part of Explorathon 2020, you can visit the website at www.explorathon.co.uk.

[00:17:59] Bye for now.