Press release

Where there's a worm there's a whale – First distribution model of marine parasites provides revealing insights

Frankfurt am Main, Germany, January 25, 2012. Each year around 20,000 people are infected by nematodes of the genus Anisakis and suffer from illnesses ranging from gastrointestinal diseases to serious allergic reactions as a result. For the first time, parasitologists from the Biodiversity and Climate Research Centre (BiK-F) have gathered data on the occurrence of the parasitic worm and have modelled the worldwide distribution of individual species in the ocean. The resulting maps not only enable statements to be made on the occurrence and migration behaviour of certain hosts of the parasites, such as Baleen or toothed whales, but also provide conclusions on the risk of human infection. The study has just been published in the renowned specialist journal "PloS ONE".

Freeloaders in the ocean

Until twenty years ago the parasitic nematode *Anisakis simplex* was still seen as one single species. Now, thanks to molecular biology, we know that the name covers nine different species, which are almost identical optically, but which differ greatly from each other in ecological and genetic terms. The marine parasites have a complex lifecycle, in which they frequently change host. The final hosts for each species are Baleen and toothed whales (so-called cetacea), which absorb the parasite with their food and act as its host until sexual maturity. In order to learn more about the distribution of the parasite and its risk potential, a team led by Prof. Dr. Sven Klimpel, head of the project group on medical biodiversity and parasitology at the Biodiversity and Climate Research Centre (BiK-F), combined data from 53 publications with the results of some molecular-biological analyses in one model approach.

Information on the occurrence of the whale hosts

The result of the different data sets is a model that demonstrates the distribution of the individual *Anisakis* species in the various oceans of the world. Parasites are a fixed component of the marine food web. Their distribution is closely connected with the nutritional habits of their intermediate and ultimate hosts, which are integrated into the lifecycles of the parasites. This means that the distribution and migration behaviour of each whale host can be derived from the model of parasite occurrence. "By means of our molecular analyses and the model based upon them we can draw

detailed conclusions about the occurrence of whale species in very specific areas and thus make statements with regard to the size of their population and stock," says Klimpel. For example, the researchers expect that some of the distribution area boundaries of the whales can be examined by means of the parasite data.

The parasite also infects humans

On the way to the whale, fish, cephalopods and crabs act as intermediate hosts for the parasites. However, just as with whales, herrings etc. can often be found on human menus. This can lead to an infection of humans with parasites via the consumption of fish, the intermediary host. Eating infected fish and fish-based products can lead to so-called *anisakiasis*. This illness often occurs in regions in which raw or semi-cooked fish is traditionally consumed. Symptoms include severe stomach pains, nausea, diarrhoea, vomiting and fever, or even severe allergic reactions. Around 20,000 people are affected throughout the world each year, with a growing tendency. Hotspots include the coastal regions of Europe, the USA, as well as Japan and developing countries, in which fish and seafood are an important source of protein. In Germany, according to Klimpel, marine fish products are examined very closely for parasites and do not currently pose any acute risk.

Distribution map helps in estimating risk of infection

The parasite distribution maps, which have been modelled for the first time, indicate clearly that each *anisakis* species is concentrated in specific distribution areas within climate zones and oceans. This is particularly connected with the distribution and migration behaviour of certain final hosts in these areas. Biologist Thomas Kuhn of the BiK-F, who is also involved in the project, summarises the significance of the study as follows: "This knowledge is essential in order to estimate the risk of an *anisakiasis* infection in certain areas in the world. This is particularly important, because infections no longer remain restricted to the one region in which the consumption of raw or insufficiently cooked fish is traditional. For developing countries in the tropics in particular, there are currently no figures on infection levels, and here we assume that there is a much higher degree of infection, since the population covers its daily protein requirements by eating freshly-caught fish."

Paper:
Kuhn T, García-Màrquez J, Klimpel S (2011) Adaptive Radiation within Marine Anisakid Nematodes: A Zoogeographical Modeling of Cosmopolitan, Zoonotic Parasites. PLoS ONE 6(12): e28642. doi:10.1371/journal.pone.0028642

Online access: http://www.plosone.org/article/info%3Adoi%2F10.1371%2Fjournal.pone.0028642

Images

Anisakis on fish liver
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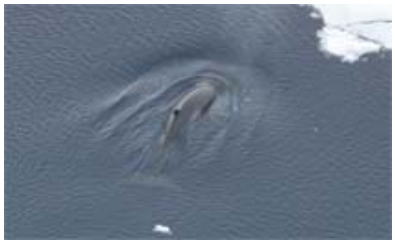

Plunging mink wale in antartica
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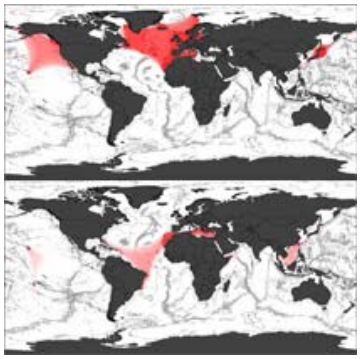
Dolphins in the Atlantic Ocean
© Sven Klimpel, BiK-F



Distribution of *Aniksakis simplex (s.s.)* (only in the northern hemisphere) and *Anisakis typica,* which are especially common in the Tropics..
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With the objective of analysis the complex interactions between biodiversity and climate through a wide range of methods, the **Bi**odiversität und **K**lima **F**orschungszentrum [Biodiversity and Climate Research Centre] (BiK-F) has been funded since 2008 within the context of the **L**andes-**O**ffensive zur **E**ntwicklung **W**issenschaftlich ökonomischer **E**xzellenz (LOEWE) of the Land of Hessen. The Senckenberg Gesellschaft für Naturforschung and Goethe University in Frankfurt as well as other, directly involved partners, co-operate closely with regional, national and international institutions in the fields of science, resource and environmental management, in order to develop projections for the future and scientific recommendations for sustainable action. For further details, please visit www.bik-f.de