

Anisakis Simplex

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01

What is Anisakis Simplex?

The ravenous Anisakis Simplex!

Anisakis simplex, known as the herring worm, is a species of nematodes in the genus *Anisakis*, which occurs in ocean fish.

They are infective to humans and they cause anisakiasis, that is a human parasitic infection of the gastrointestinal tract¹.

Anisakis species have complex life cycles which pass by a number of hosts through the course of their lives.

Life cycles

The Eggs come from fish feces and they hatch in seawater.

Larvae are eaten by crustaceans.

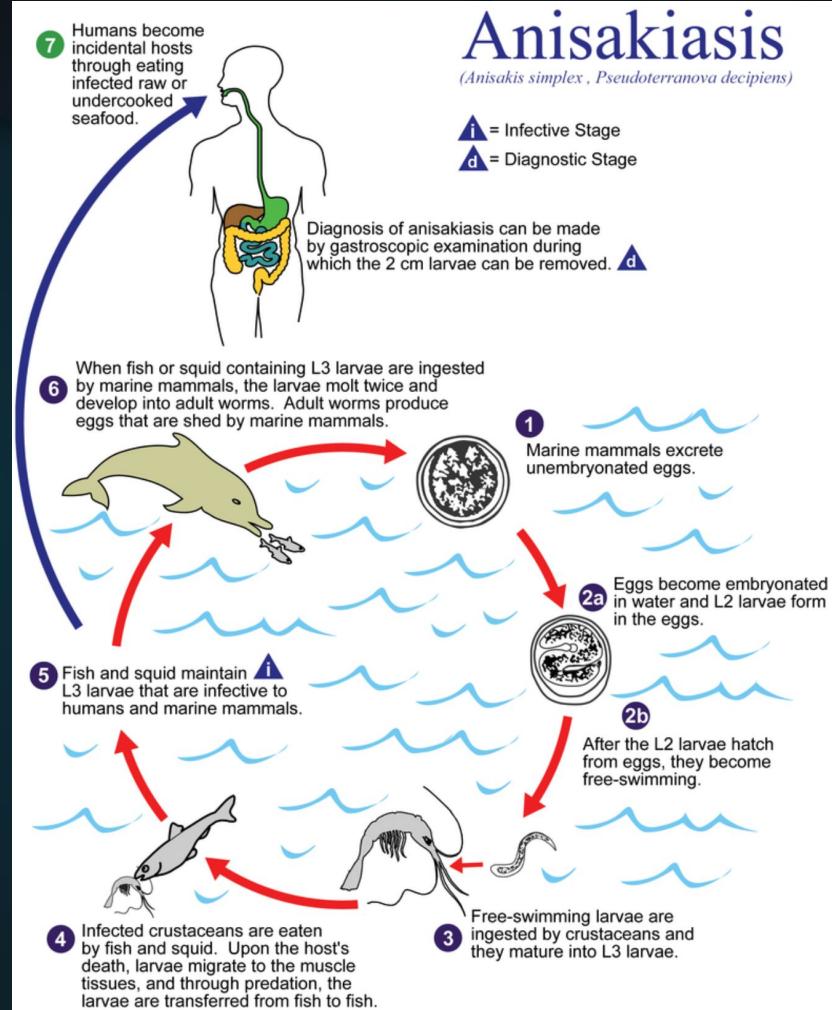
The infected crustaceans are subsequently eaten by fish, the nematodes burrow into the wall of the gut.

The life cycle is completed when an infected fish is eaten by a marine mammal.

The nematode grows, mates, and releases eggs into the seawater in the host's feces.

Anisakis species are able to infect humans who eat raw or undercooked fish¹.

1: [Anisakis simplex life cycles](#)

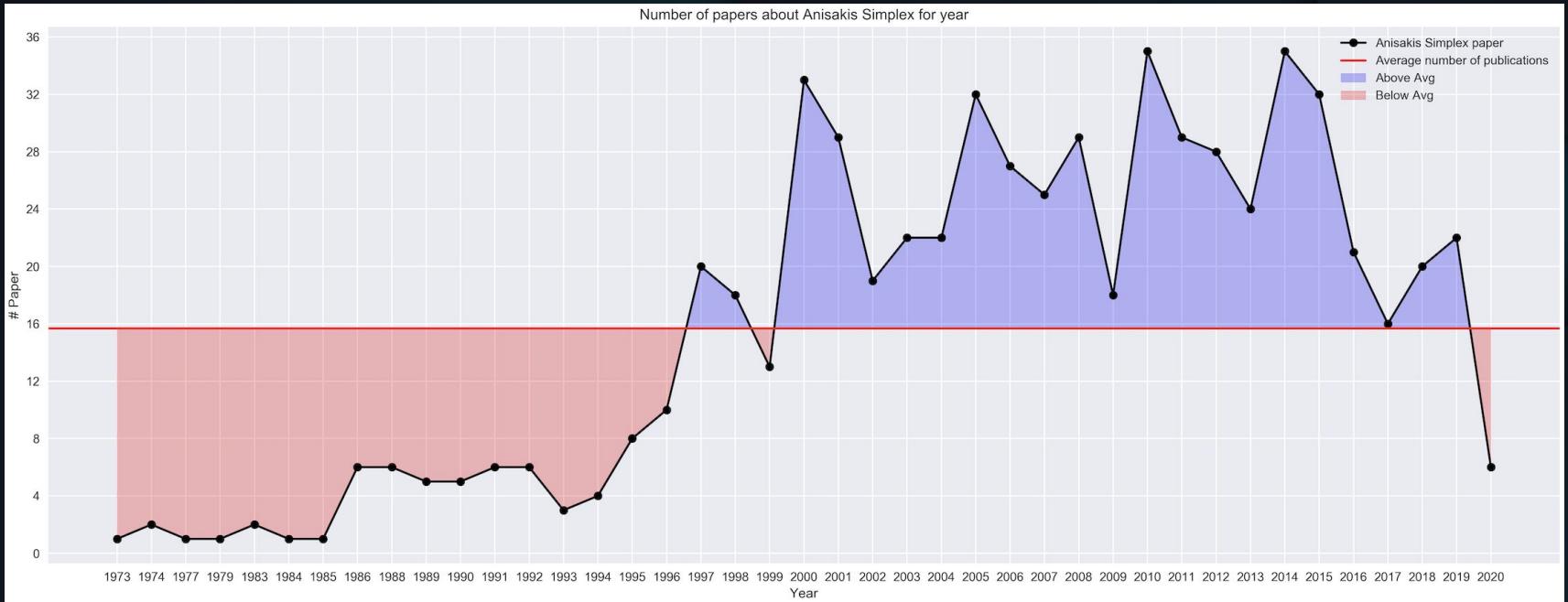


02

PubMed Analysis

What is it PubMed database?

PubMed is a database that comprises more than 30 million citations for biomedical literature from MEDLINE, life science journals, and online books. Citations may include links to full-text content from PubMed Central and publisher web sites¹.



This analysis has been done on Publication date field, we can observe a very controversial situation at the turn of the two centuries.

The rise of the number of publications could be indirectly caused by sushi restaurants spread; raw or undercooked seafood could increase anisakiasis¹ infection. Of course a major noticed by lawmakers helped the increment of the research².

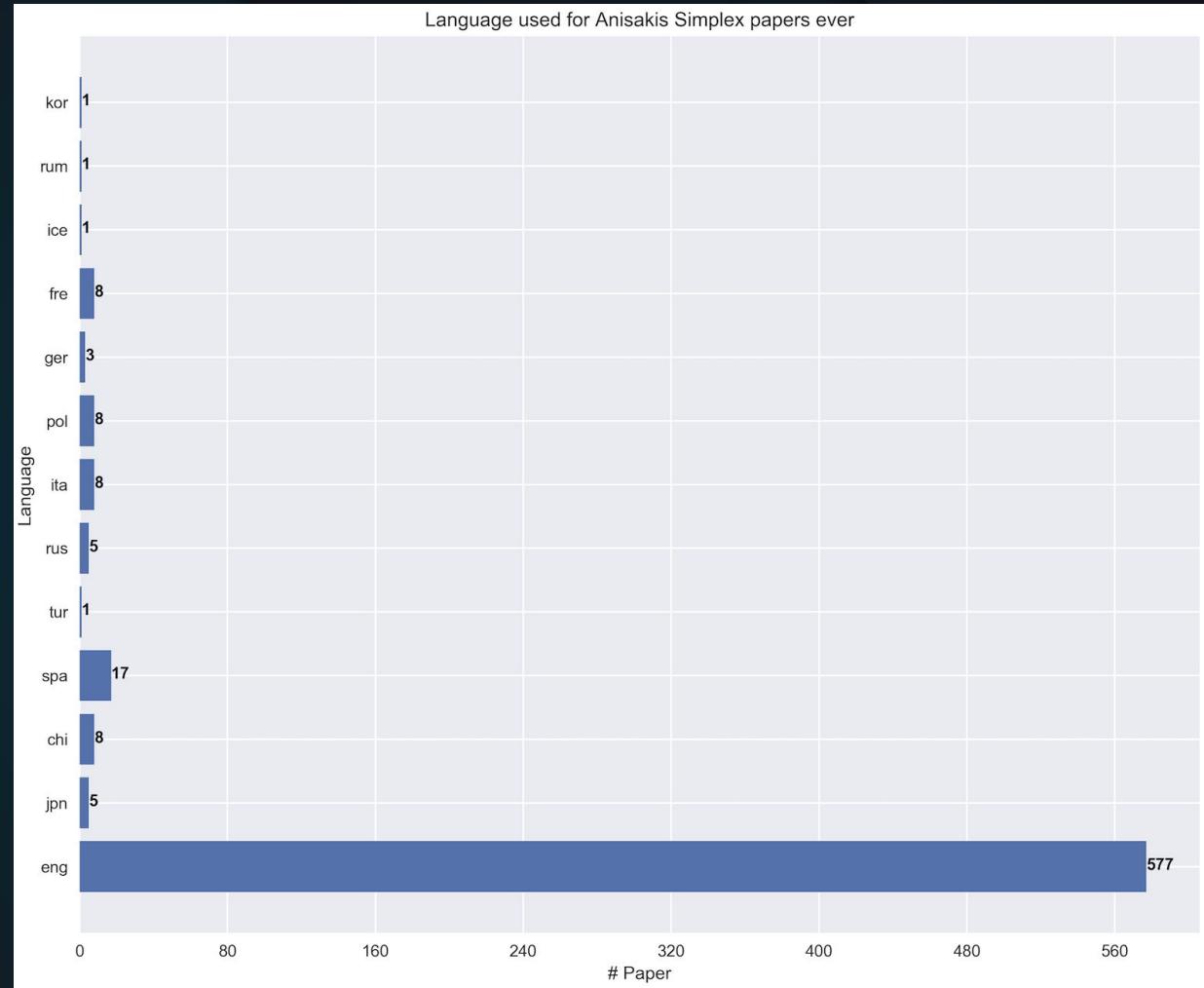
1: Anisakiasis

2: Official Journal of the European Union

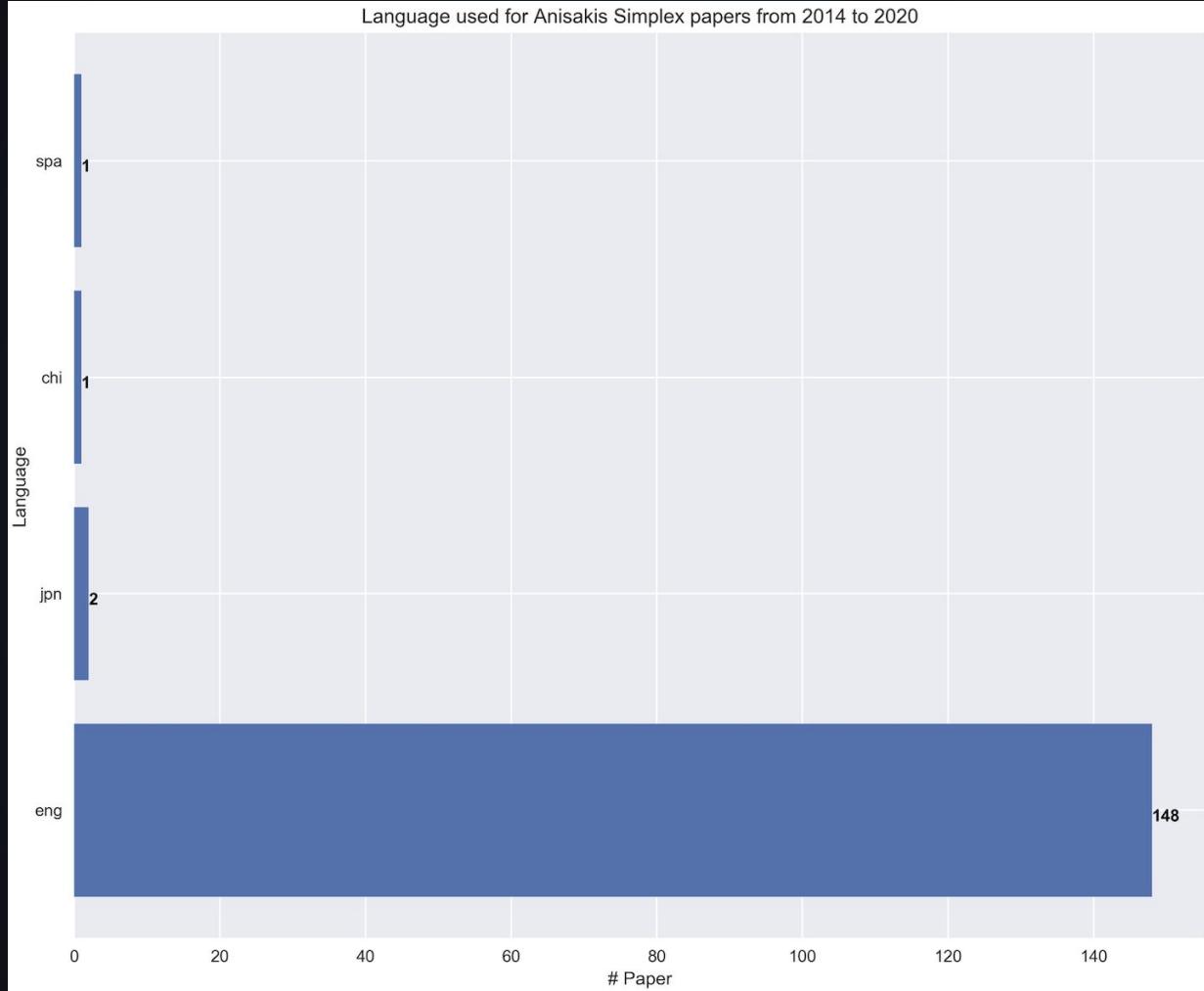
**The most used language is english
but there are interesting numbers in
spanish too...**

**... this will find and investigate
in other analysis that we will
present soon.**

**The tendency of writing in a own
language is typical of the last
century and start of a new one...**



Language used for Anisakis Simplex papers from 2014 to 2020



...in the last 5/6 years, almost all paper has been written in english.

From 2018 all papers are in english.

These analysis have been done on paper's language field.

Word Cloud about Anisakis Simplex title papers ever

In this title word cloud, made on title field, a lot of word recall object of research.

Fish, larvae, larval, third stage are all world about Anisakis life cycle.

Interested notice the name of the Atlantic ocean, this ocean has some of the world's richest fishing resources¹.



Word Cloud about Anisakis Simplex abstract papers



in the same way, the word cloud of the paper abstract, reflects object of the search.

**There are a major big words as IgE
(Immunoglobulin E) is a type of antibody
that has only been found in mammals,
main function is immunity to parasites.**

The word Human, infection, IgE, anisakiasis, antigen and allergen we could think that a lot of studies are focused on anisakiasis case in the human.

The authors names word cloud shows a lot of Spanish names...

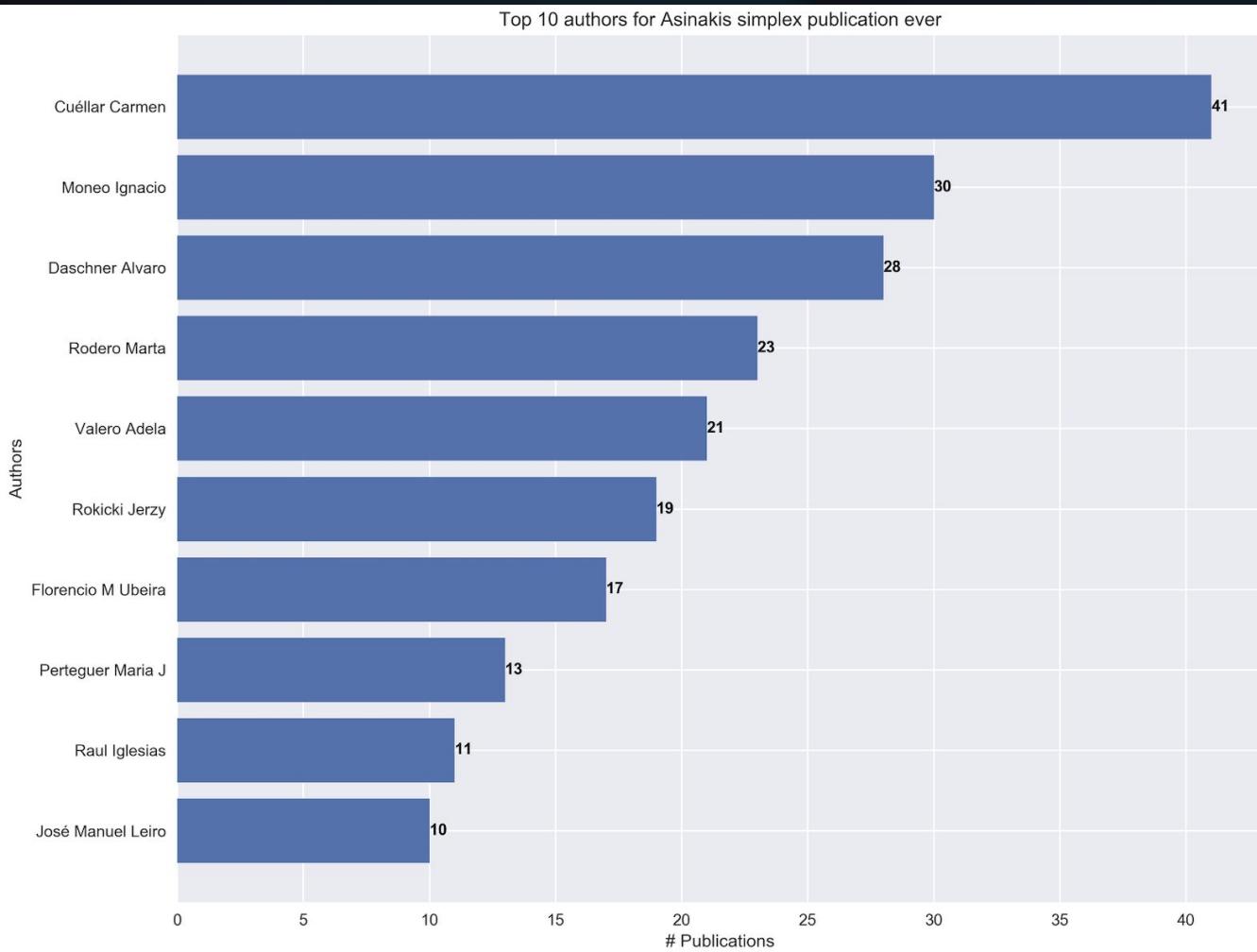
... remember that the Spanish is the second most used language for the paper.

This Spanish research presence could be caused by the high fish eating tendency'.

Word Cloud about Authors names



Top 10 authors for Asinakis simplex publication ever



Another confirm of Spain involved situation is shown in this analysis...

...almost all top 10 authors of paper are Spanish teachers, doctors or researchers.



Maria Del Carmen Cuellar Del Hoyo

Complutense University of Madrid - Spain - Facultad de Farmacia

143 Publications 1948 Citations¹

Ignacio Moneo

Hospital Carlos III of Madrid - Spain

184 Publications 9304 Reads 4013 Citations²



Jerzy Rokicki

**University of Gdańsk - Poland - Department of Invertebrate Zoology
and Parasitology**

155 Publications 11579 Reads 1043 Citations³

¹: [Google Scholar](#)

²: [Researchgate](#)

³: [Researchgate](#)

Most of researchers are based in “hot” places...

...Spain and Japan are more affected by anisakiasis.

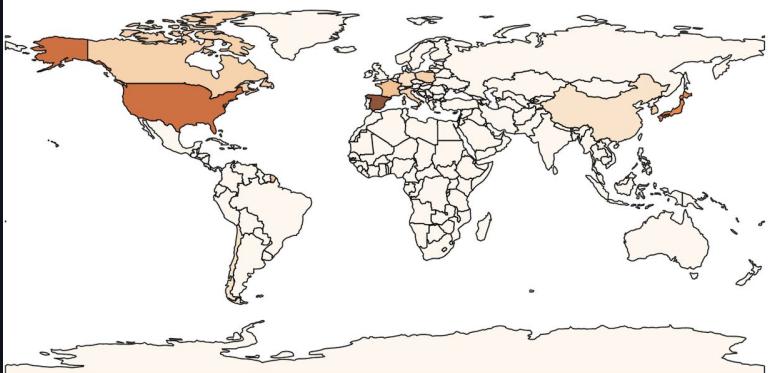
Other countries, where fishing consuming is high, are colored².

- 1: Anisakis spread
- 2: Anisakis presence

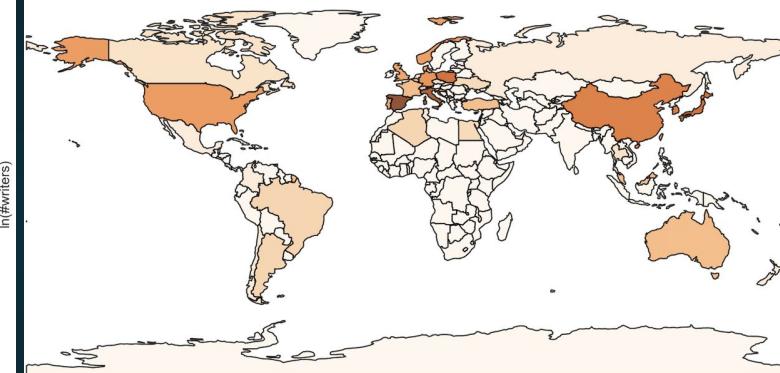


The Chinese case

Writers per country from 1973 to 1999



Writers per country from 2000 to 2020



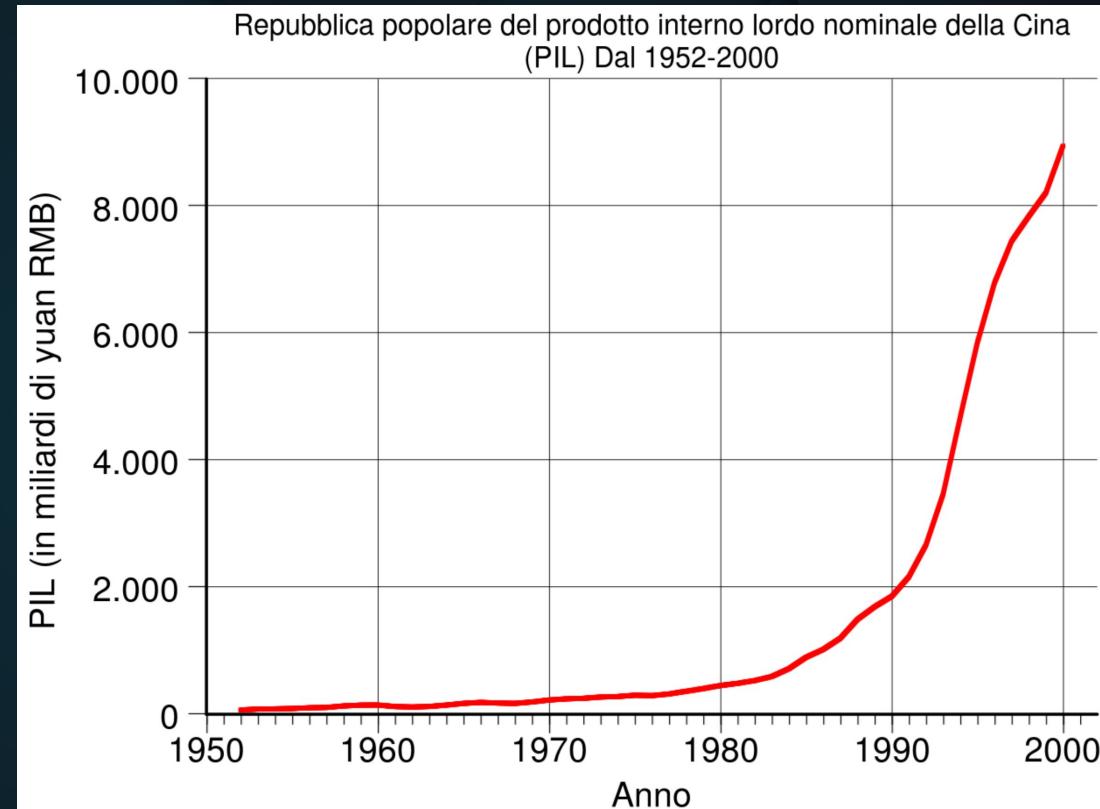
Note the increasing numbers of researchers in China along the period...

The Chinese Economic Boom

China continues to increase its investments in scientific research and technological development...

...the Asian country will surpass the USA¹.

In 2018, China's investments in R&D reached 2.9% of GDP².

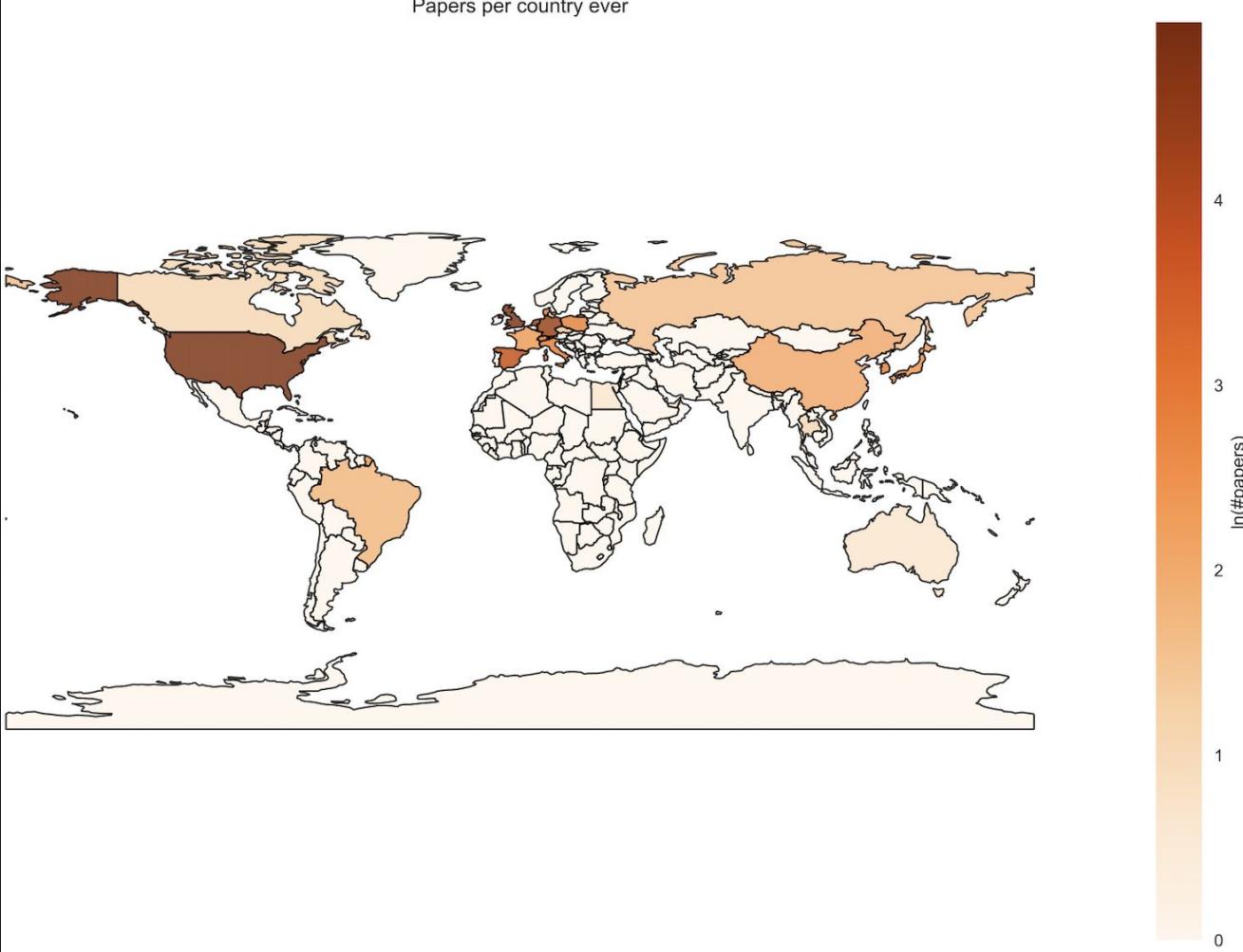


1: Spending in research

2: China: record of investments in research and development

3: Chinese GDP increase graph

Papers per country ever

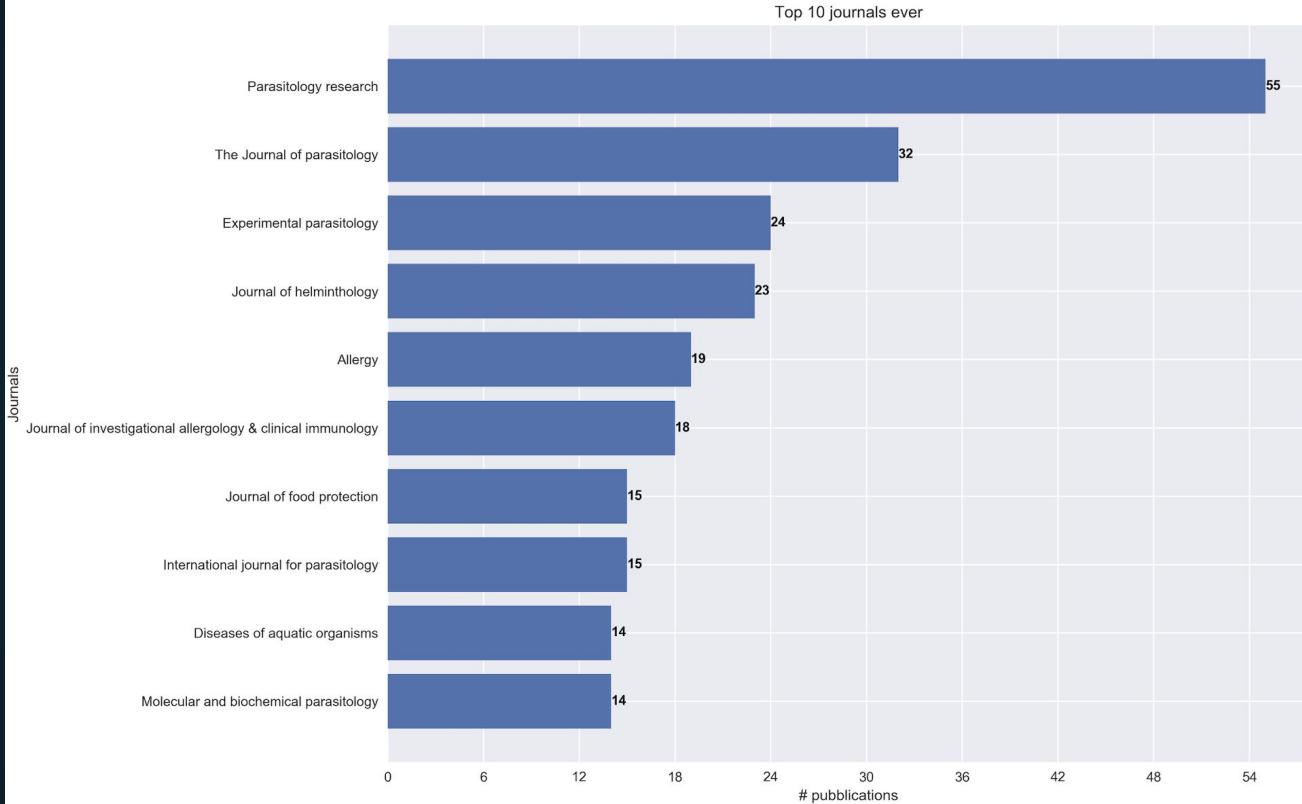


Most of scientific journals are based in Occidental country...

...in Europe there is a very old history of scientific journals¹.

I: Academic journal

Top 10 scientific journals title recall recall the anisakis behaviour.



03

Dryad Analysis

What is it Dryad database?

This dataset is a set of data collected through the accurate analysis of a set of publications, to identify the documents that estimate the abundance of anisakis, a research was conducted in the ISI Web of Science, on 10 October 2017, which produced 2,284 documents.

[Link to presentation](#)

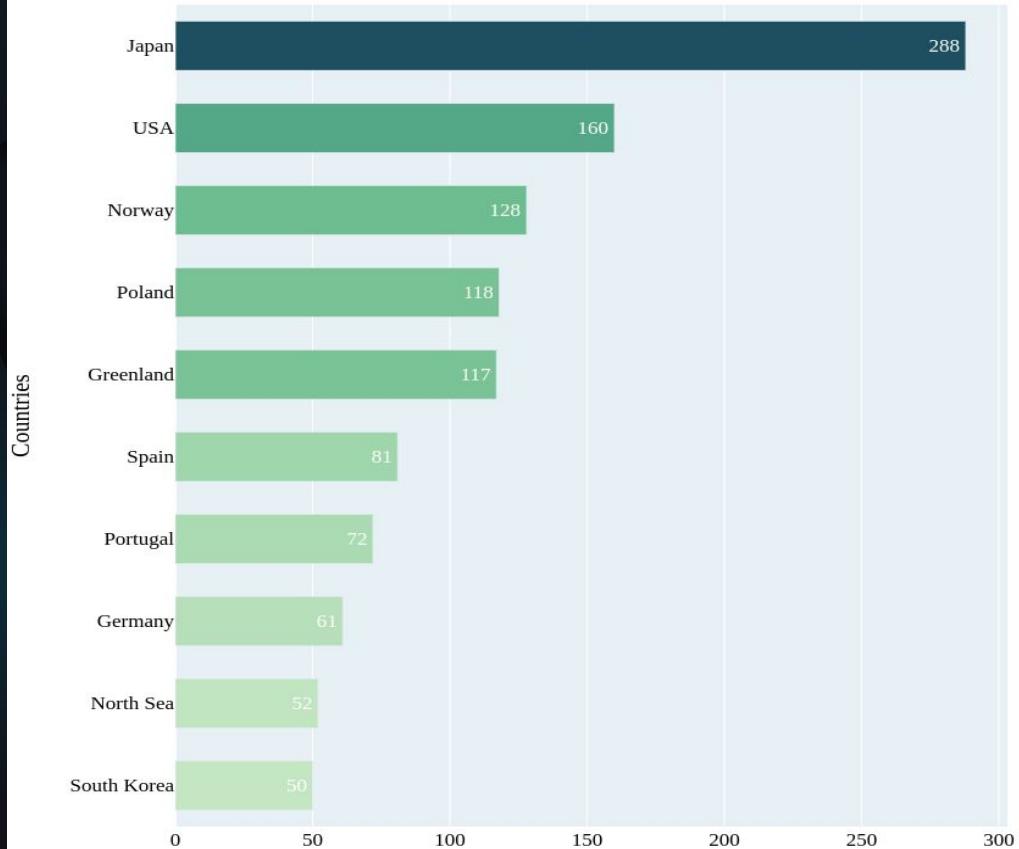
04

Nucleotide Analysis

What is it Nucleotide database?

The Nucleotide database is a collection of sequences from several sources, including GenBank, RefSeq, TPA and PDB.Genome, gene and transcript sequence data provide the foundation for biomedical research and discovery.

Top10 countries by number of accessions:



As previously seen, the country that are the larger consumer of raw fish, are also the ones that have submitted more accessions over time.

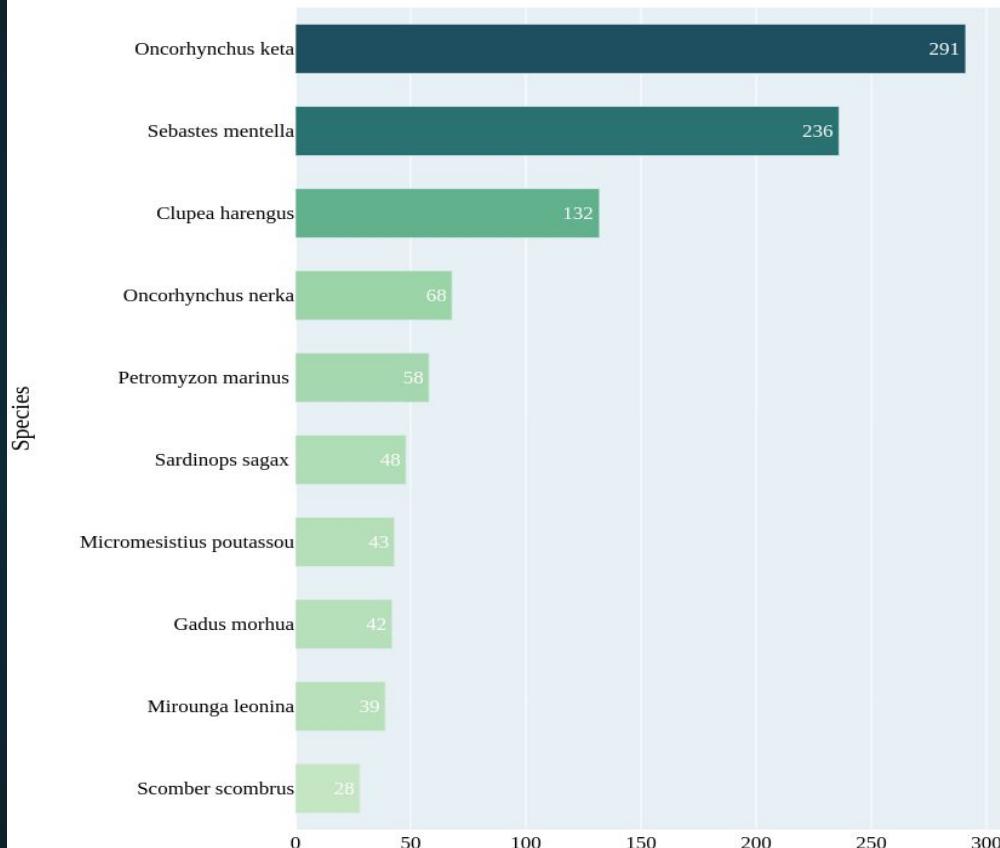
The most representative host animals are bony fish of the actinopterygii class, caught especially for commercial purpose.

In this top 10 we have found one particular exception in the sea lamprey...

it seems that the sea lamprey is a further reservoir host of A. Simplex...

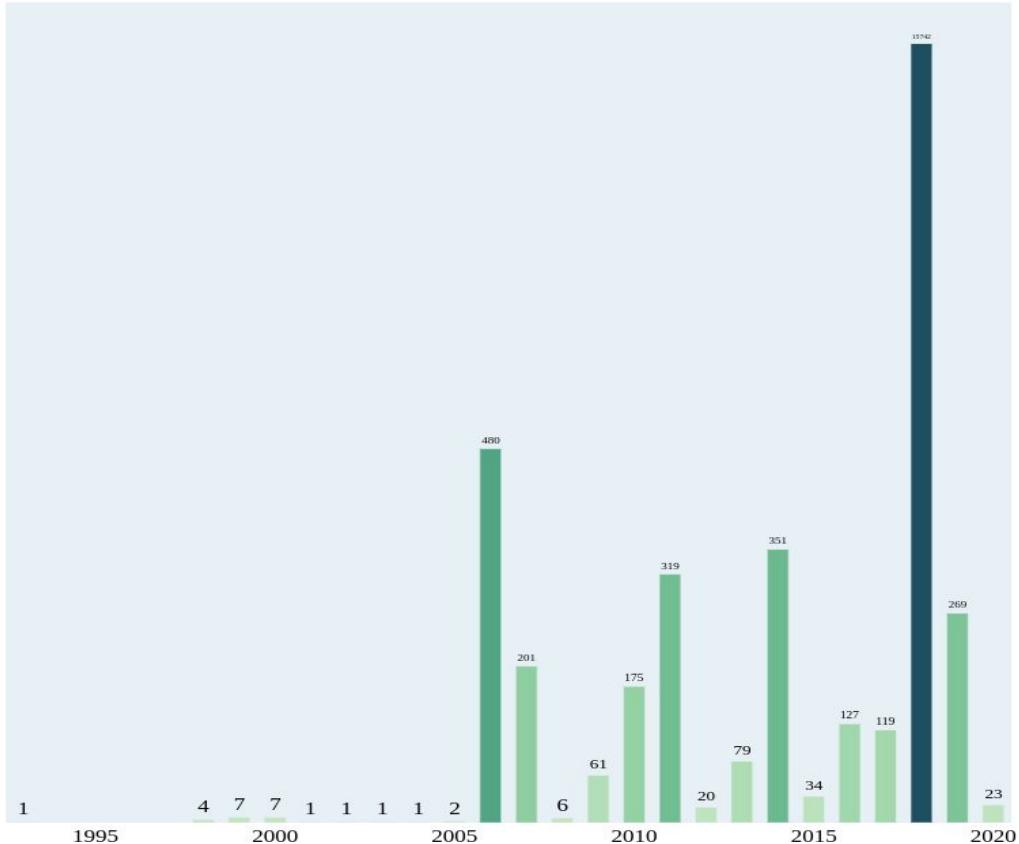
...so the cycle of Anisakis can be modified including the sea lamprey¹.

Top10 host by number of accessions:



¹:<https://www.sciencedirect.com/science/article/pii/S0956713513000844>

Total accessions by year:



The distribution of creation dates also reflects the increase of interest in anisakis over the past two decades.

Why that peak of 15k accessions in 2018?

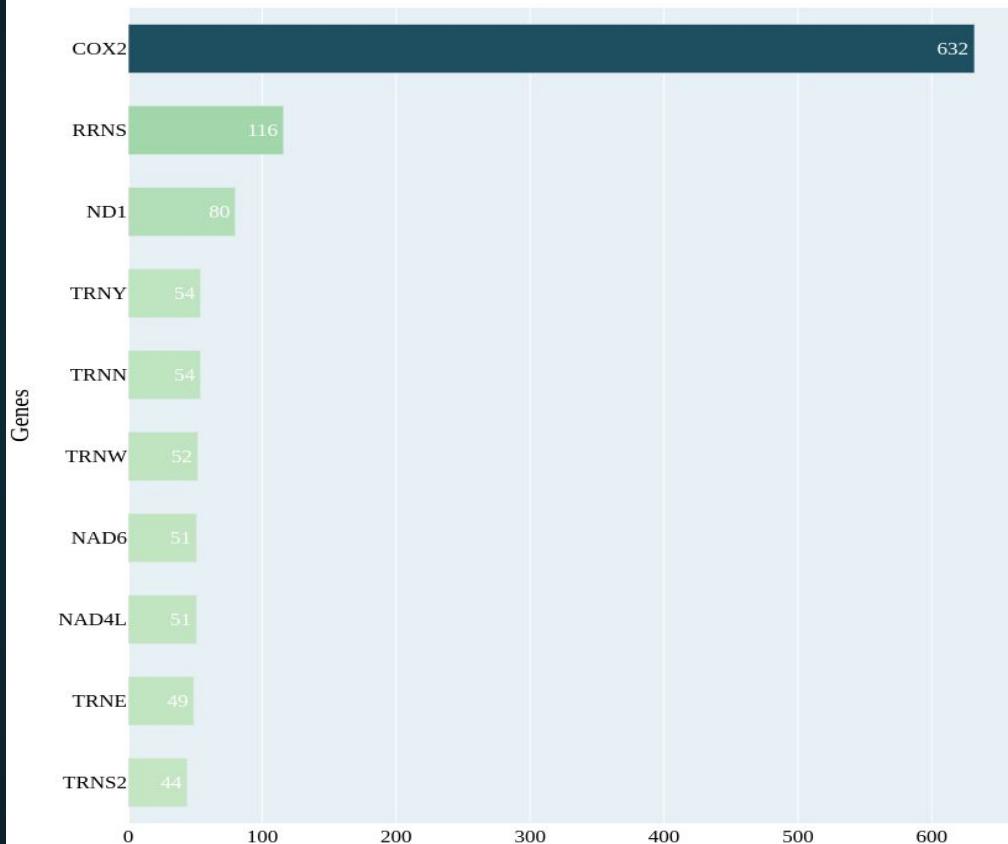
Because of the whole genome sequencing made by Sanger Institute(UK)

The most typical genes are all of mitochondrial origin...

reflecting the fact that most of the sequences probably comes from DNA barcoding experiments

...so COX2 is the preferred target gene!!!

Top10 gene by number of accessions:



05

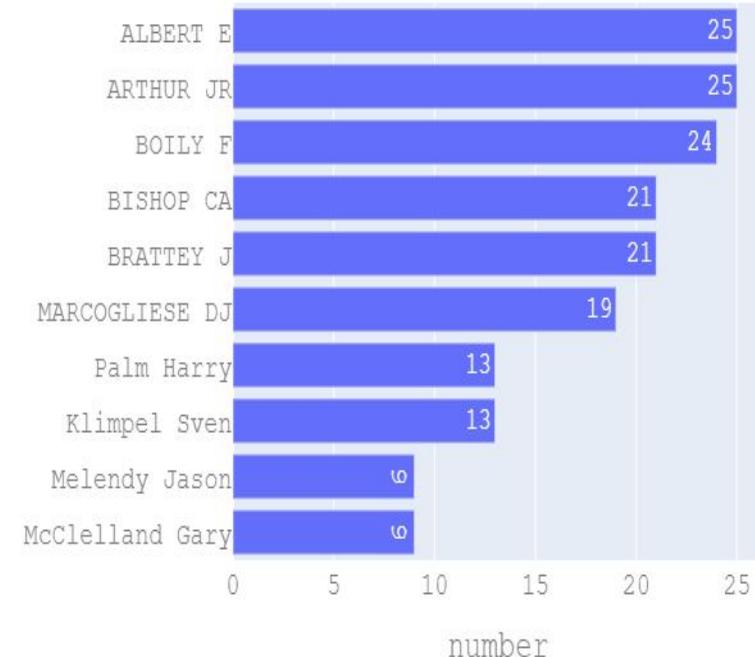
Open Questions

**Could be exist a clusters structures in
pubmed papers?**

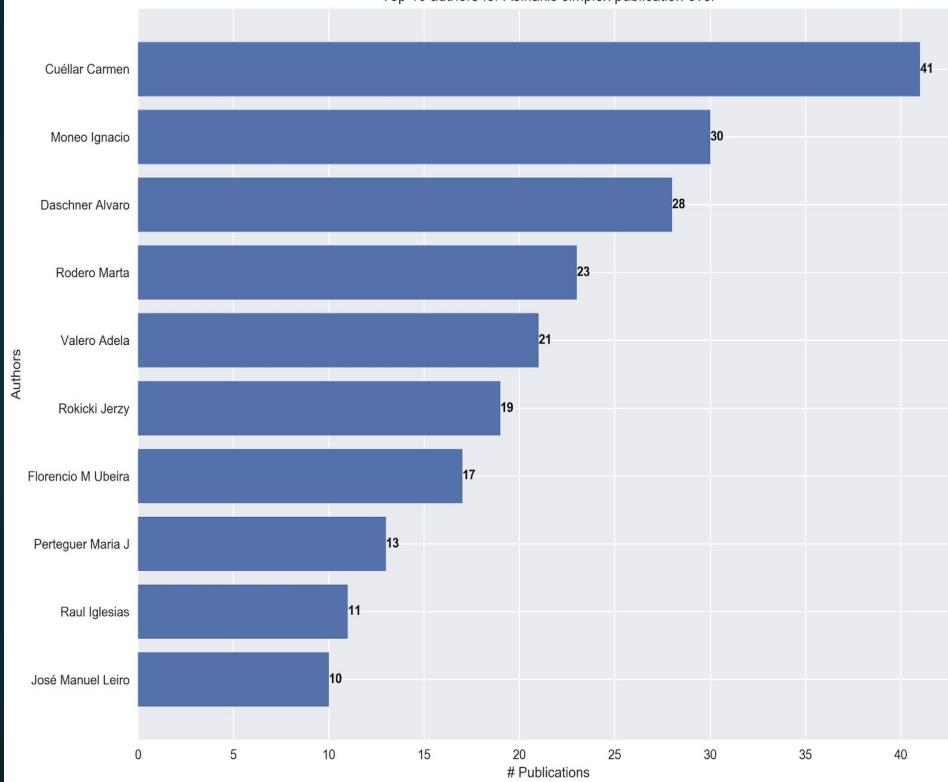
**Is there any relationship between
anisakis host?**

Dryad dataset is a subset of Pubmed ?

Top 10 authors dataset Dryad

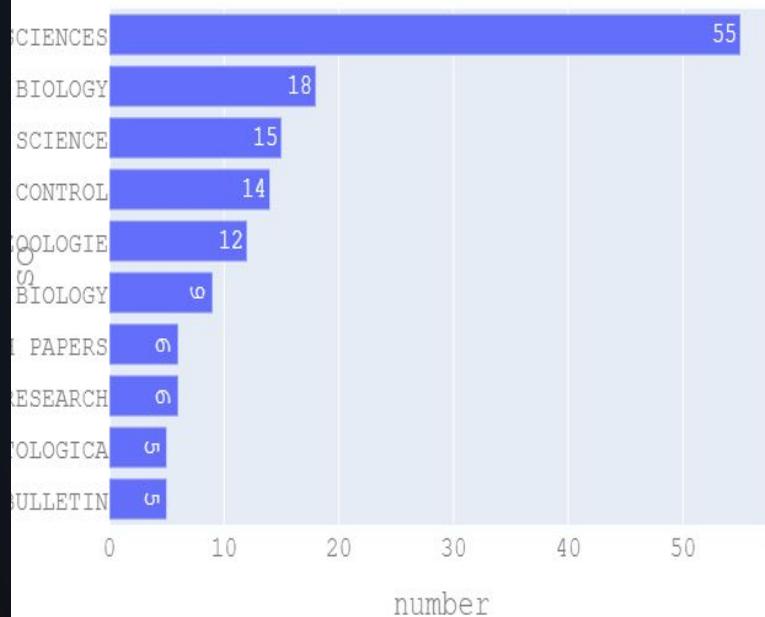


Top 10 authors for *Asinakis simplex* publication ever

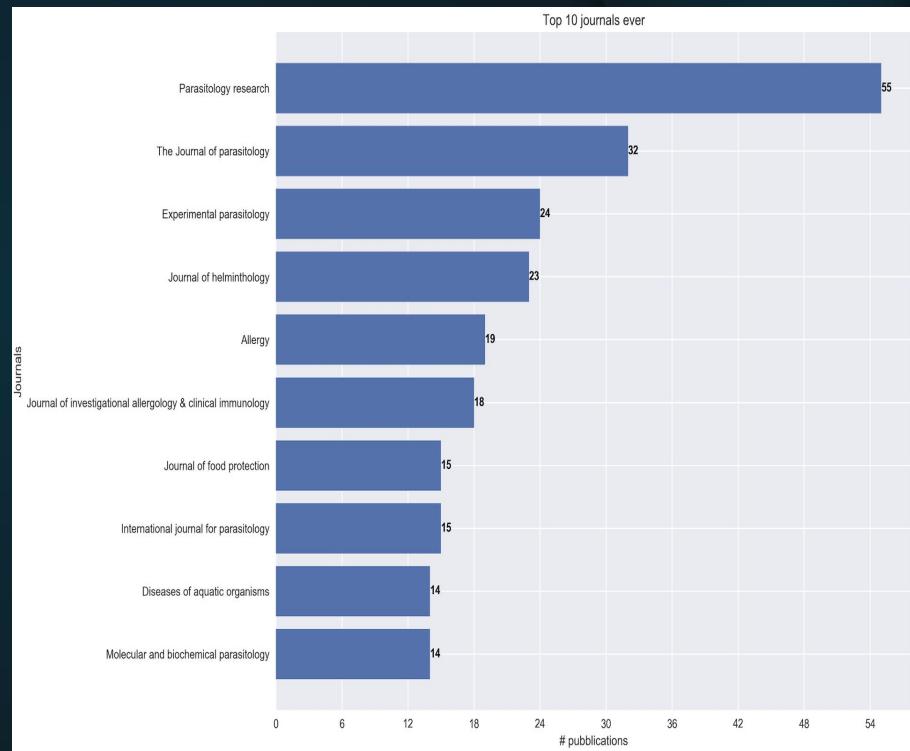


Dryad dataset is a subset of Pubmed ?

Top 10 publication sites dataset Dryad



Top 10 journals ever



THANK YOU FOR THE ATTENTION!

Does anyone have any
questions?