NIWA
Taihoro Nukurangi

Journey of an open-source software for fisheries acoustics

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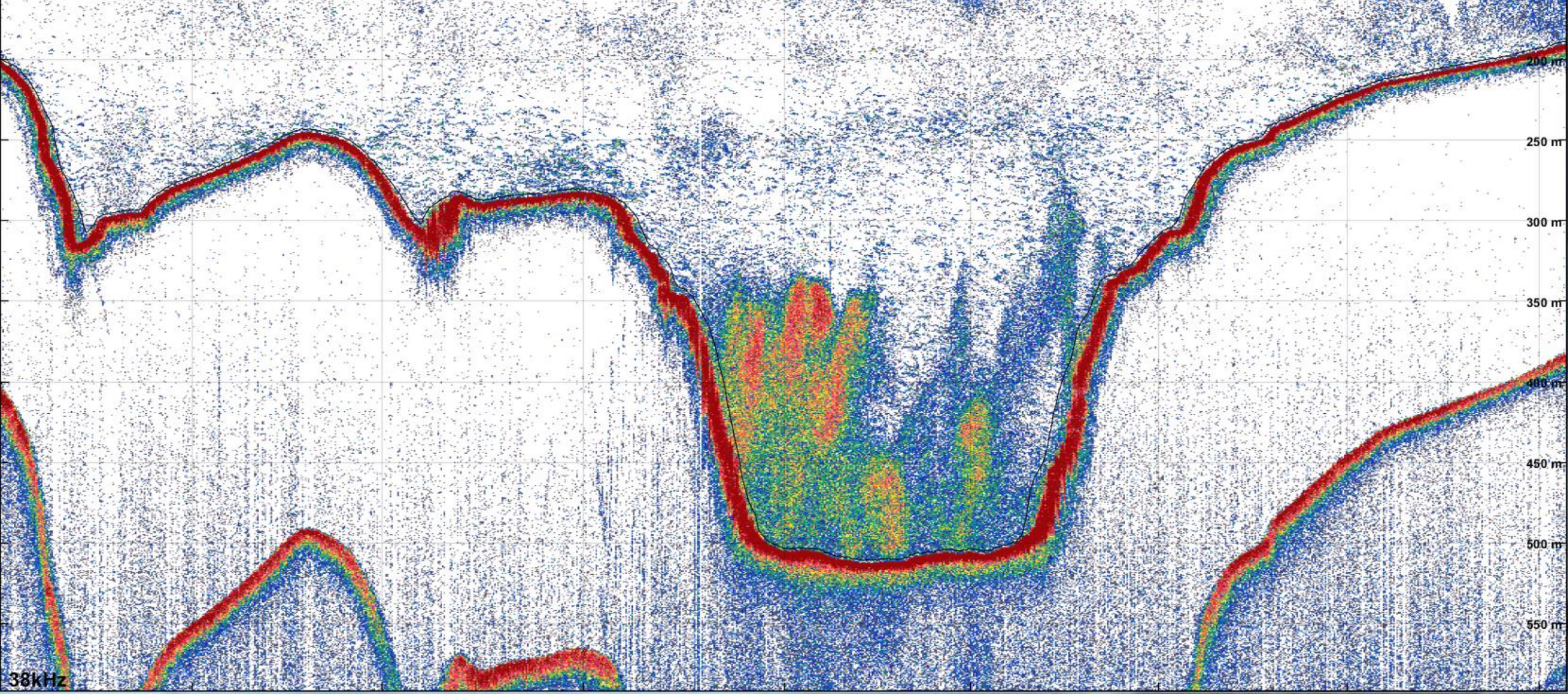
CAPAM : Coordination, project planning, hosting, and funding



Background

What is ESP3?

- ~500 000 lines of code in:
- Matlab/Java/C++
- Team:
- 1 main developer, and 2 dedicated to maintenance/comments/documentation
- 3 “key-users” providing regular planned feedbacks
- x (x>0 & x<10) active contributors to the repository
- A user base of around 50 to 100 researchers/students

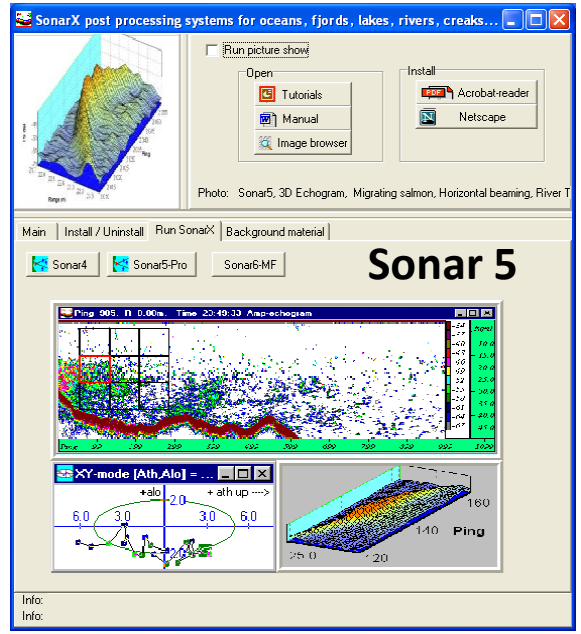
The wonderful microcosm of fisheries acoustics software

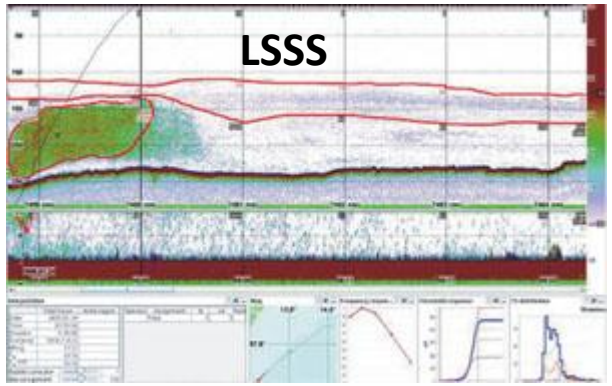
Proprietary

- Echoview (software company)
- Large Scale Survey System (*IMR/MAREC*)
- Sonar 4 and 5
- Movies 3D *(IFREMER)*

Open-source

- ESP3 (*NIWA*)
- PyEcholab *(under development)*





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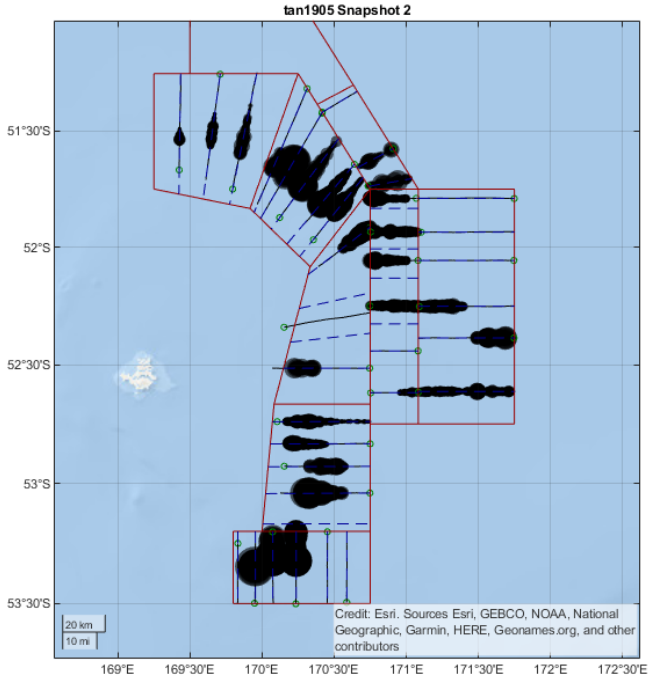
What does ESP3 do for a living?

- Acoustic instruments calibration
- Acoustic survey analysis: biomass estimation

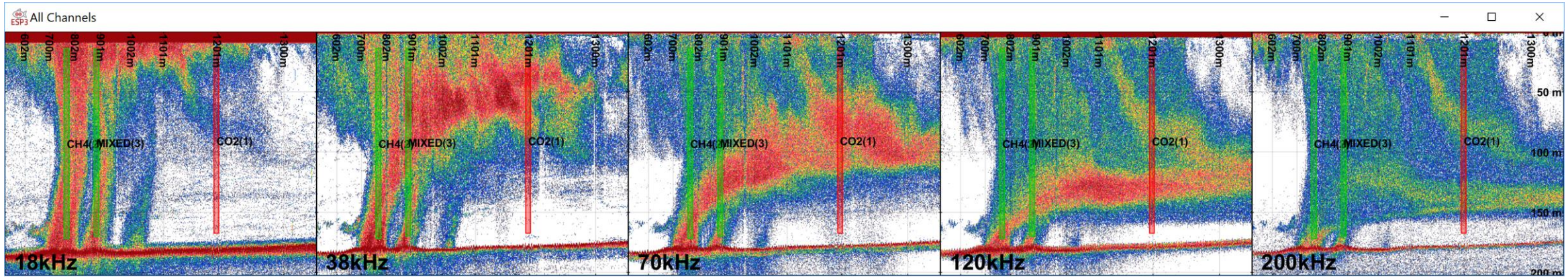
(Cook strait hoki survey, Campbell plateau southern blue whiting survey,…)



- Spatio-temporal studies of changes in backscatter :

Escobar-Flores, P. C., Y. Ladroit and R. L. O'Driscoll (2019). "Acoustic Assessment of the Micronekton Community on the Chatham Rise, New Zealand, Using a Semi-Automated Approach." Frontiers in Marine Science **6(507).**

- Water column feature identification/extraction



Where does it live?

For developers:

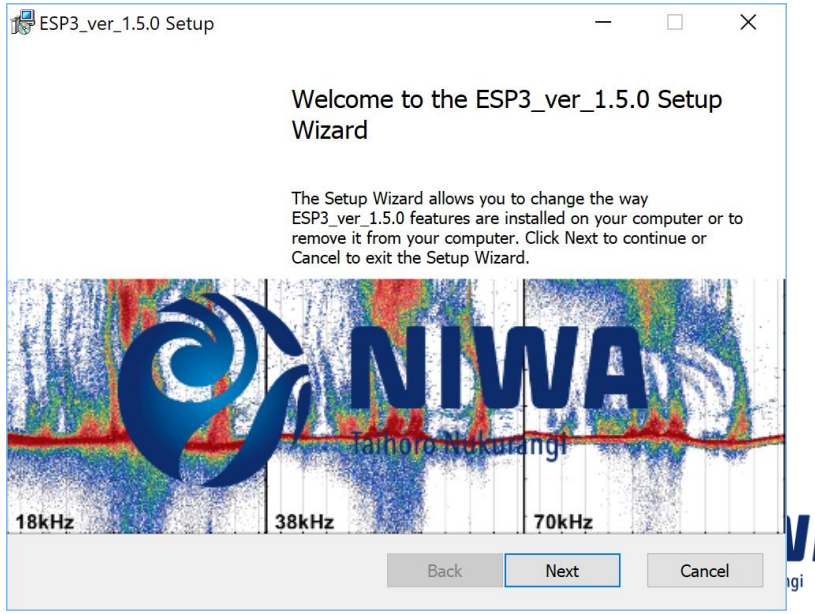
- Access the source code, follow the development, branch, pull-request, join the fun using Git:

  https://bitbucket.org/echoanalysis/esp3/

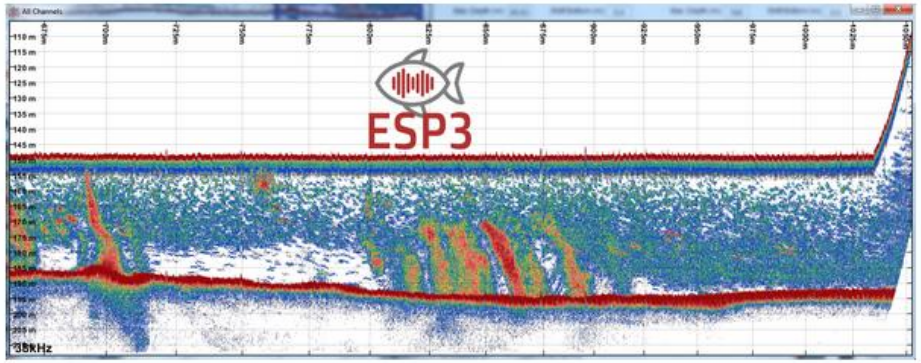
For normal people:

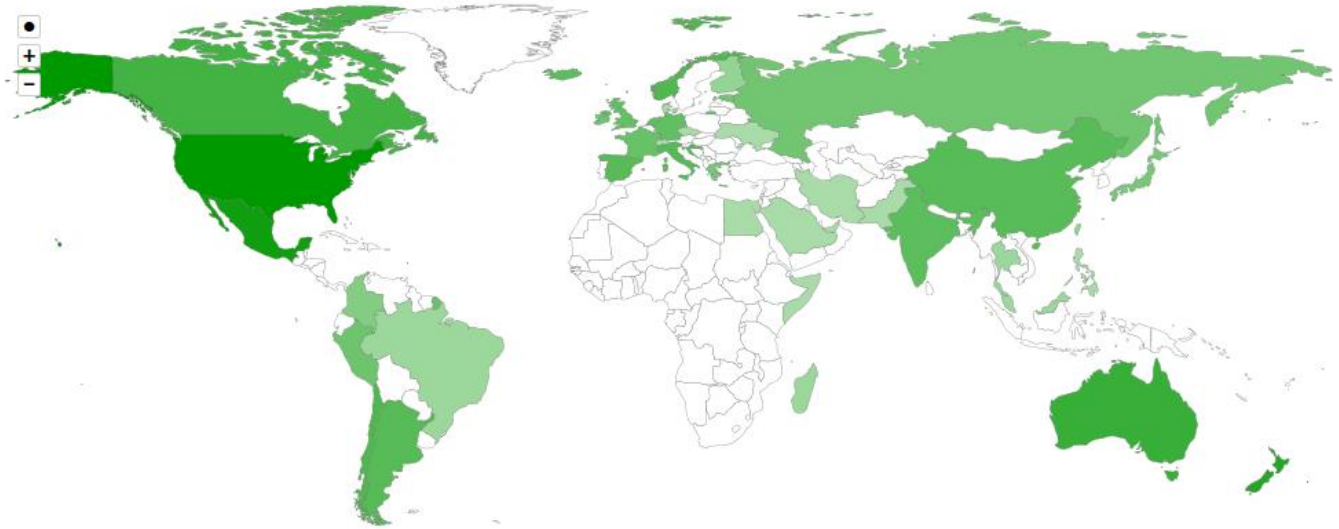
- Available as a windows installer (Unix version on its way):

https://sourceforge.net/projects/esp3/



Current state of affairs





User base

- Around 50-100 consistent users
- Used in multiple universities and laboratories:
  USGS, University of Hawaii, University of Washington, University of Aberdeen, University of Belfast, CCOM/UNH, NOAAA, IMR, AAD, CSIRO, University of Oregon… and others…
- Strong interest from students

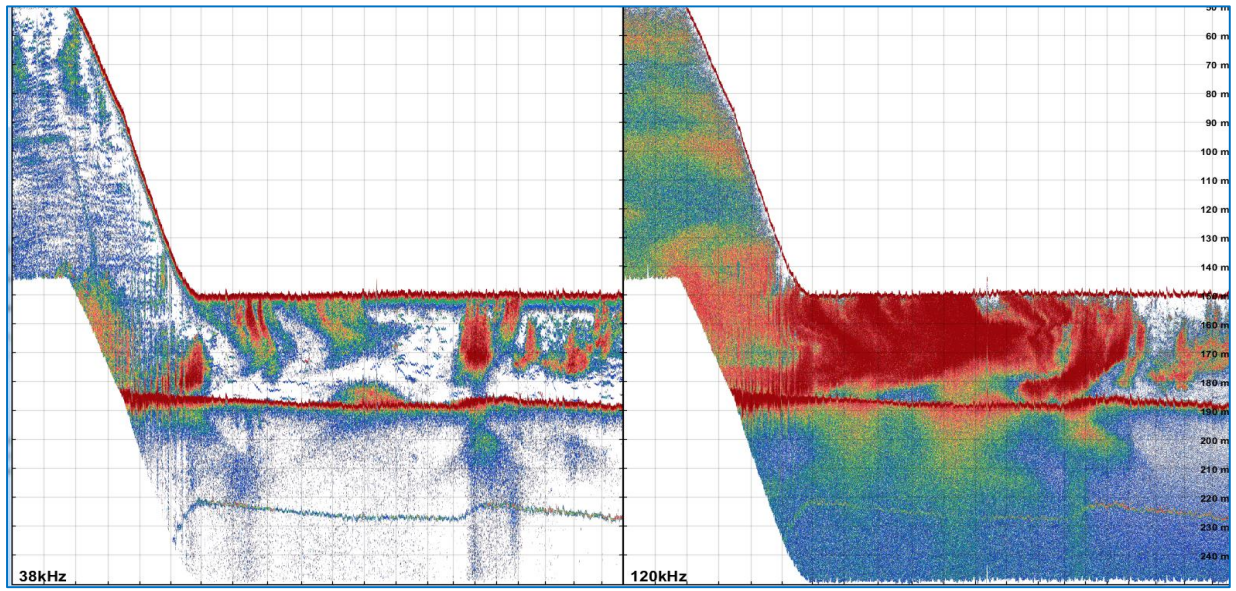
Outreach

- Since 2017 >1000 downloads
- 45 countries (5 continents)
- Two demonstration sessions at international meetings (ICES WG-FAST): Nelson (2017) and Galway (2019)
- One-day training course in Galway (2019)
  - 10 researchers from 7 countries

Motivations

- ~~One Software to rule them all~~
- replace our old analysis software
- keep consistency in our time series:
- unable to fully reproduce results using existing tools
- ensure reproducibility of results
- have control over the code we use
- be able to implement modern processing methods

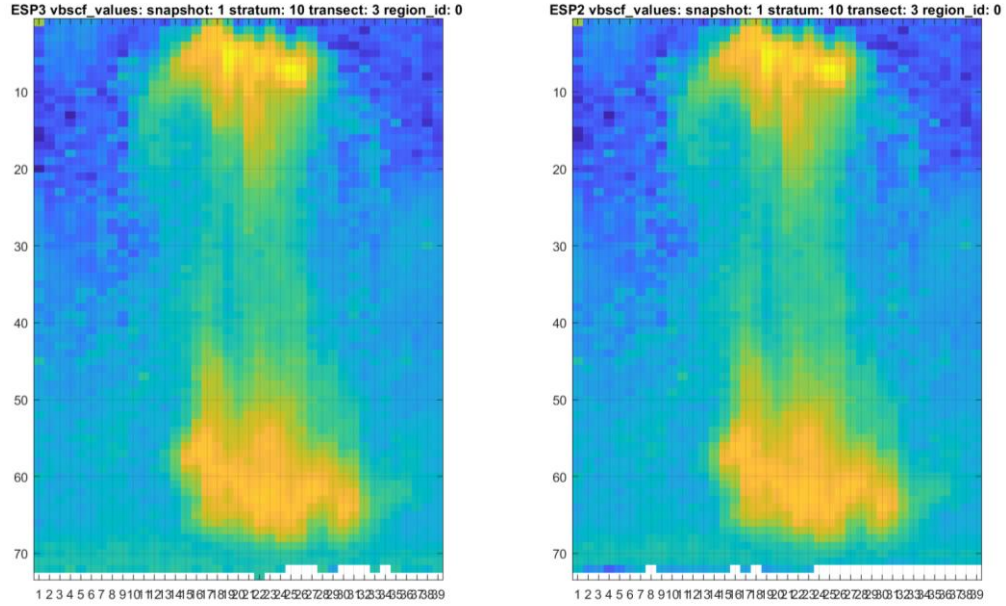
Inception: born by accident

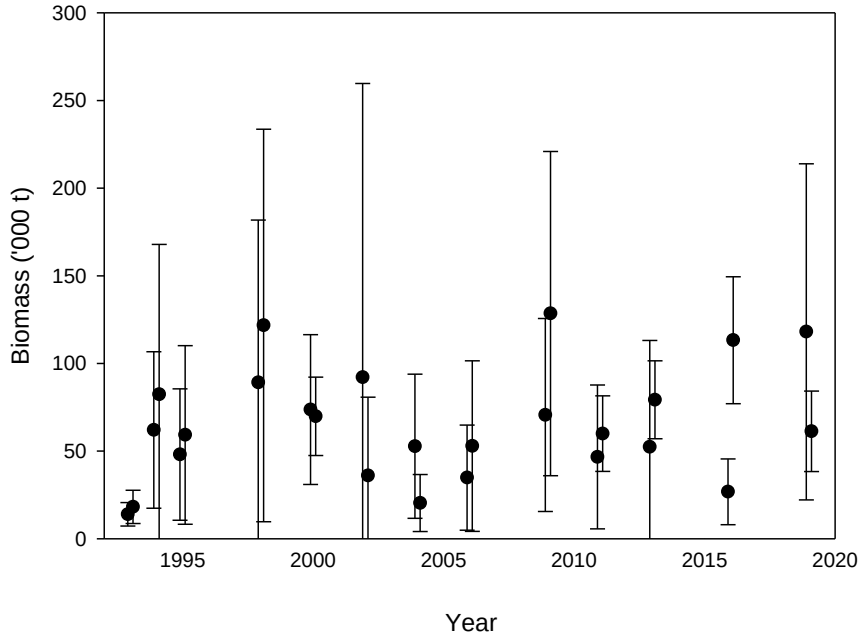


Project started in January 2015 in the Ross Sea, on Tangaroa, to read Simrad EK80 files.

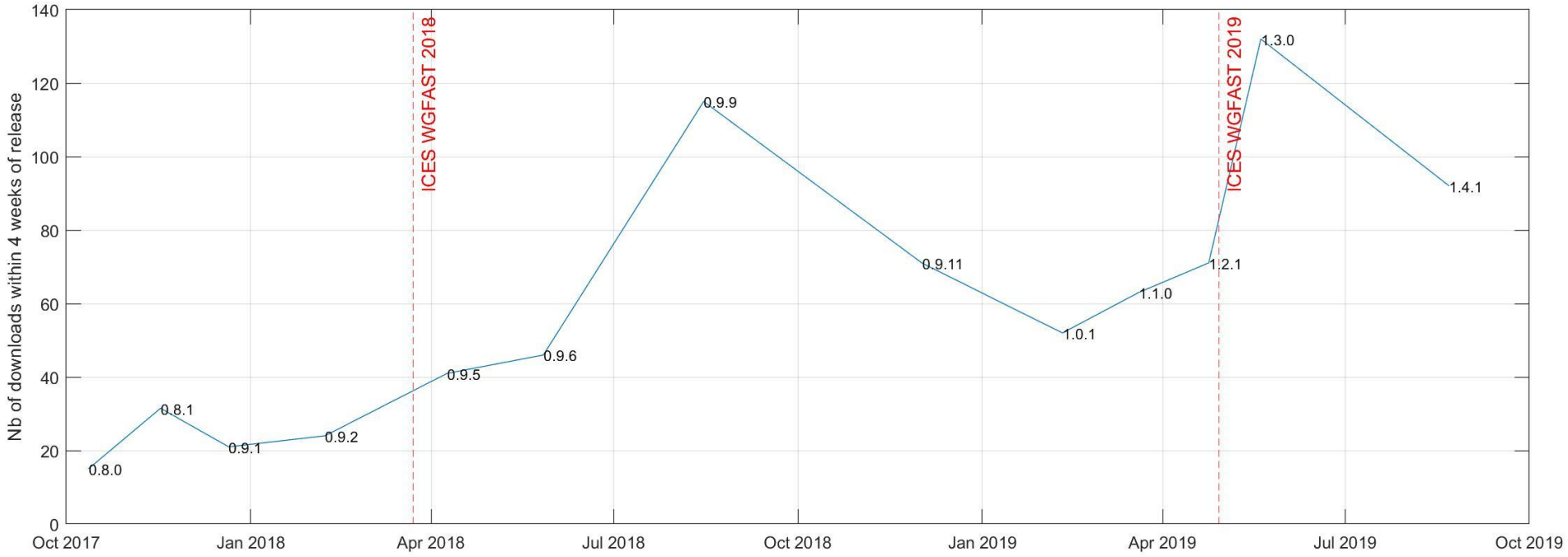
Evolution:
from prototype to “production”

- 2016: Decision to make ESP3 NIWA’s acoustic analysis tools
- Re-analysis of time series and comparisons of outputs (software “cross-calibration”)
- Re-design of the object structure
- Iterative process between users (biologists) and developer(s) begins
- March 2017: code published under MIT license
- New developers join the project (internally and externally)
- User documentation and code commenting process starts formally…
- October 2017: first full installer made available





How was it received?



How do we plan ahead?

- Keeping up to date with hardware (instrum
- communicate with the manufacturers

- Regular discussions with key-users
- seek feedbacks

- Explore new possibilities/methods
- keep a close eye on the literature

- We don't…
- adapt to unforeseen events

Where does the money come from?

- Documentation/code maintenance and commenting:
- NIWA core-funding (tools development)

- New features:
- on a project per project basis
- external contributions

- Exploratory work:
- while bored at sea…

- Travelling/attending conferences:
- training courses

If I had to do it again…

What would I change?

- The name
- Produce a full installer early
- A better early Git management of the project
- Introduce automated unit testing procedures from the start

What would I keep?

- The object oriented structure
- A simple but complete graphical interface
- Most technical choices (GPU processing, memory mapping,…)
- Interactions with users

Things I have learned in the process

- Any minor change requires a complete testing and “cross-calibration”
- There is no such thing as an intuitive new feature
- There can be two valid results (or more)
- Git is my best friend
- Whatever I have coded 6 months ago makes no sense today if I have not commented it

Thank you

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Climate, Freshwater & Ocean Science

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