

Data Curation, Fisheries and Ecosystem-based Management : The Case Study of the Pecheker Database

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Introduction

- The scientific monitoring of the Southern Ocean French fishing industry is based on the use of the Pecheker database, developed and maintained by a team of scientists of the Muséum national d'Histoire naturelle (MNHN).
- Pecheker is dedicated to the digital curation of the data collected on field by scientific observers and which analysis allows the scientists of the MNHN institution to provide guidelines and advice for the regulation of the fishing activity, the protection of the fish stocks and the protection of the marine ecosystems.
- Pecheker includes various sets of raw data about the fishing activity (catches for target and by-catch species, effort...) and the biodiversity of the impacted ecosystems with completeness in time, space and taxa.

Context

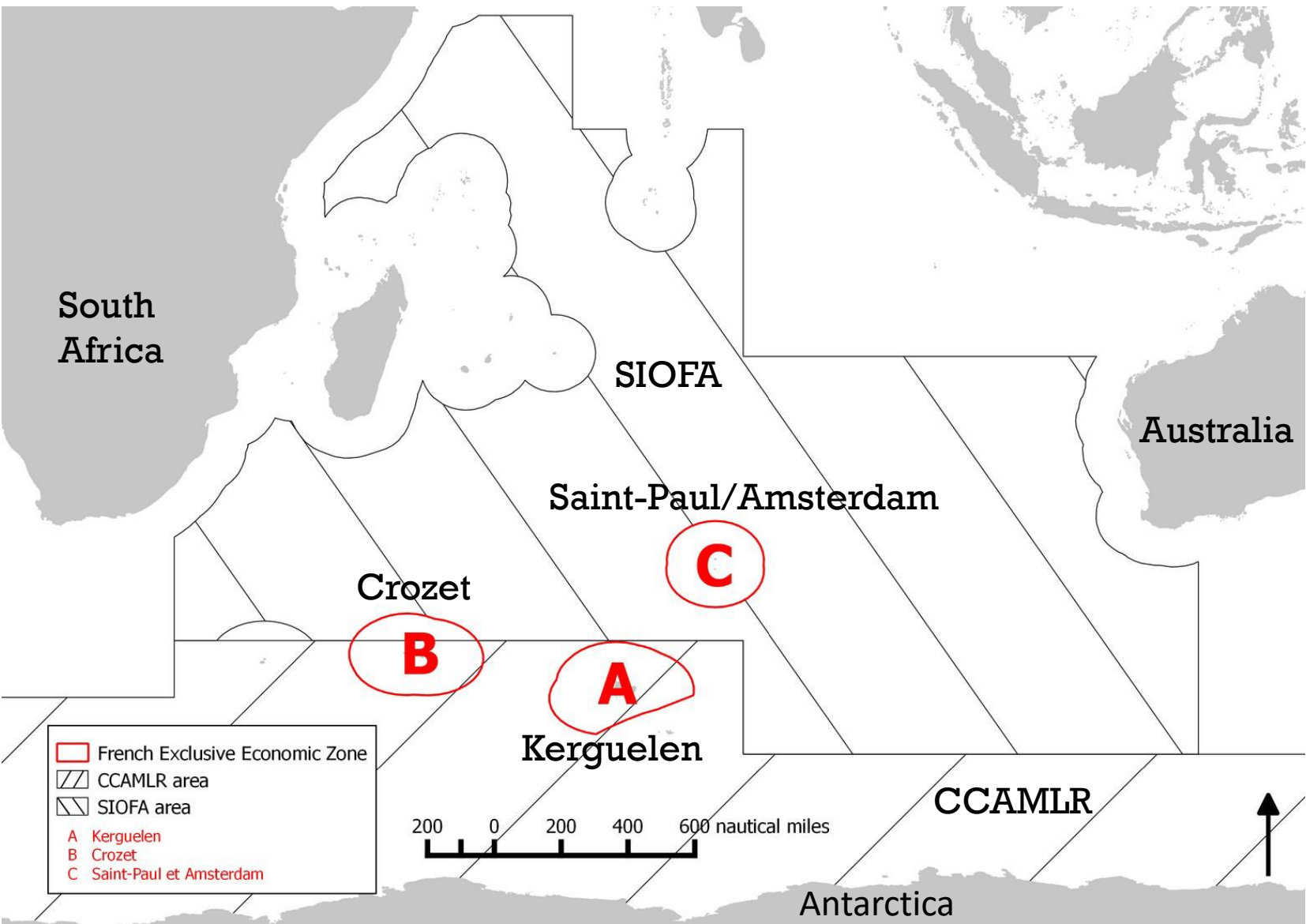


Figure 1: Geographical location of the French southern Exclusive Economic Zones of Kerguelen (A), Crozet (B) and Saint-Paul et Amsterdam (C).

- Fisheries in different areas, territories and distinct legal framework (Figure 1):
 - 3 French Exclusive Economic Zones (EEZ) under the "French Southern and Antarctic Territories" administration.
 - 2 international areas ruled by two distinct international organisations (SIOFA, CCAMLR)
- Various fishing activities (longline, trap...).
- 1978 : Monitoring program debut.
- 1997: Electronic logbook.
- 2008: Pecheker first version.
- 2013: Major updates and Pecheker latest version.

Methods



ECOSYSTEM-BASED PARADIGM

Comprehensive data: checked then uploaded in Pecheker at the end of each fishing trip

- Fishing operations (time, latitude, longitude, depth).
- Gears deployment, including full technical description.
- Mitigation devices deployment.
- Catches of target and by-catch species.
- Fish and lobster biometry.
- Specimen sampling.
- Observations of birds, mammals and benthic invertebrate species.



- Surpass the limits of the classical monitoring approaches by improving the data quality.
- Consider the environmental context of the fisheries.

Acknowledgments

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We also acknowledge all the fishery observers from the Terres Australes et Antarctiques Françaises who provide raw data.



Photo credit

Photo by fishery observers

Development

- The template of Pecheker has been developed to make the database adapted to the ecosystem-based management concept.
- It includes various flexible structures allowing researchers to describe, to organize and to name the information exceeding the core data with a set of generic columns in non-thematic tables.
- Pecheker is based on an Oracle 11G® relational database hosted in a remote server.
- Custom R scripts and SQL views are used to access the database.
- Upstream and downstream data flow design.
- "Halieutique": a prototype atlas including aggregated statistics dynamically computed from Pecheker (Figure 2).

- **Thematic tables** to store core data, structured in columns each dedicated to a single type of information.
- **Non-thematic tables** to store unstructured data, opportunistic observations, data from non permanent acquisition protocols or data from permanent protocols but implying a huge amount of information.
 - 6 generic columns to describe and structure information.
 - Controlled vocabulary.

- More **suitable** to prevent upcoming evolutions in data acquisition (no need to add new columns or tables when a new field protocol is introduced).
- **Interoperability** : integration of Pecheker data within regional databases and reuse of data for global analysis.
- **Independent** from the electronic logbook and its development.
- **Metadata** record and description of field protocols.

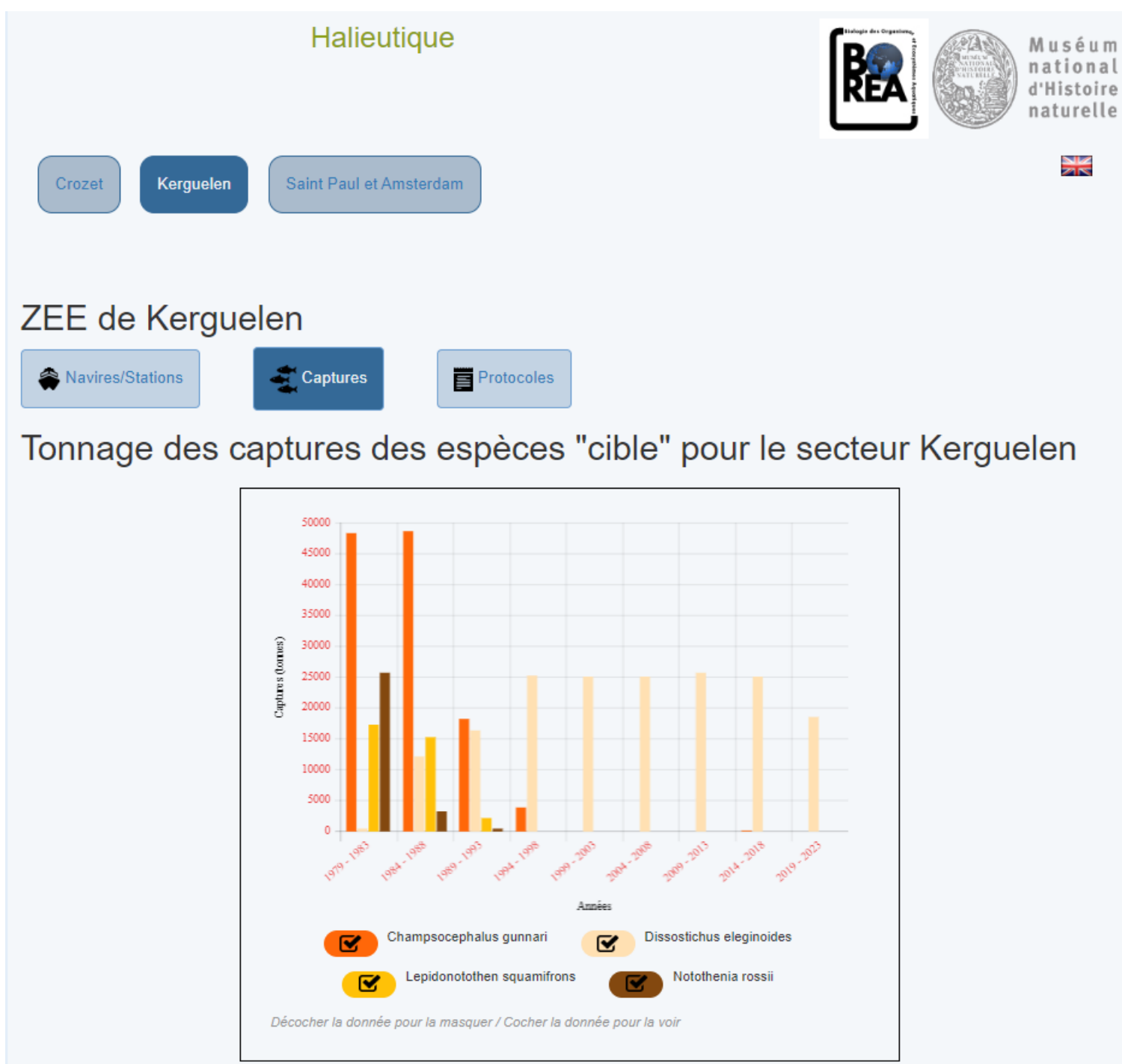


Figure 2: Screenshot of "Halieutique" the prototype atlas. <http://halieutique.mnhn.fr>



Full code to deploy a database based on the Pecheker template is provided in the QR code.

Dataset in early 2023 : some key numbers

- Fishing operations > 420 000
- Taxa for caught organisms > 120
- Biometry > 4 300 000
- Biological samples > 60 000
- Tagging > 116 000
- Recapture > 16 000

Success factors

- Permanent funding, team and hosting of the database within a state institution.
- Availability of the whole data in a centralized repository and the high quality of the raw data with continuous data curation.
- Pecheker is based on the principle that "smaller is more sustainable".
- The spatial extent is restricted to a limited geographical area defined by political boundaries and not by large ecological regions.
- A single monitoring program.
- The community around Pecheker is restricted and no open-access.

These various factors allow us to provide a data curation service which reaches a high effectiveness level, with a high level of accuracy, adequacy and completeness of the database, justifying the existence of Pecheker for the various stakeholders and the funding from the French state.

Conclusion

Pecheker project constituted an important step for the monitoring program, with the integration of the data into a complete dedicated information system, allowing the setting of a digital curation policy and a strong improvement of the information availability.

Reference

Martin A., Chazeau C., Gasco N., Duhamel G. & Pruvost P. (2021), Data curation, fisheries and ecosystem-based management: the case study of the Pecheker database, *International Journal of Digital Curation*, 16(1), 32 pp.

