



Optimal Processing Routes for a Marine Biorefinery



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INTRODUCTION AND OBJECTIVES

CASE STUDY

20 Mt/year of unwanted/non-targeted species and specimens are discarded



TWO APPROACHES

Reducing unwanted catch

Increasing unwanted catch/biomass utilisation

Added-value products from discarded fish

CHALLENGE

Species can be handled by more than one processing route



There is a need of **selecting the optimal processing routes** of the different biomasses in terms of sustainability.

- Utilities costs
- Market prices
- Production

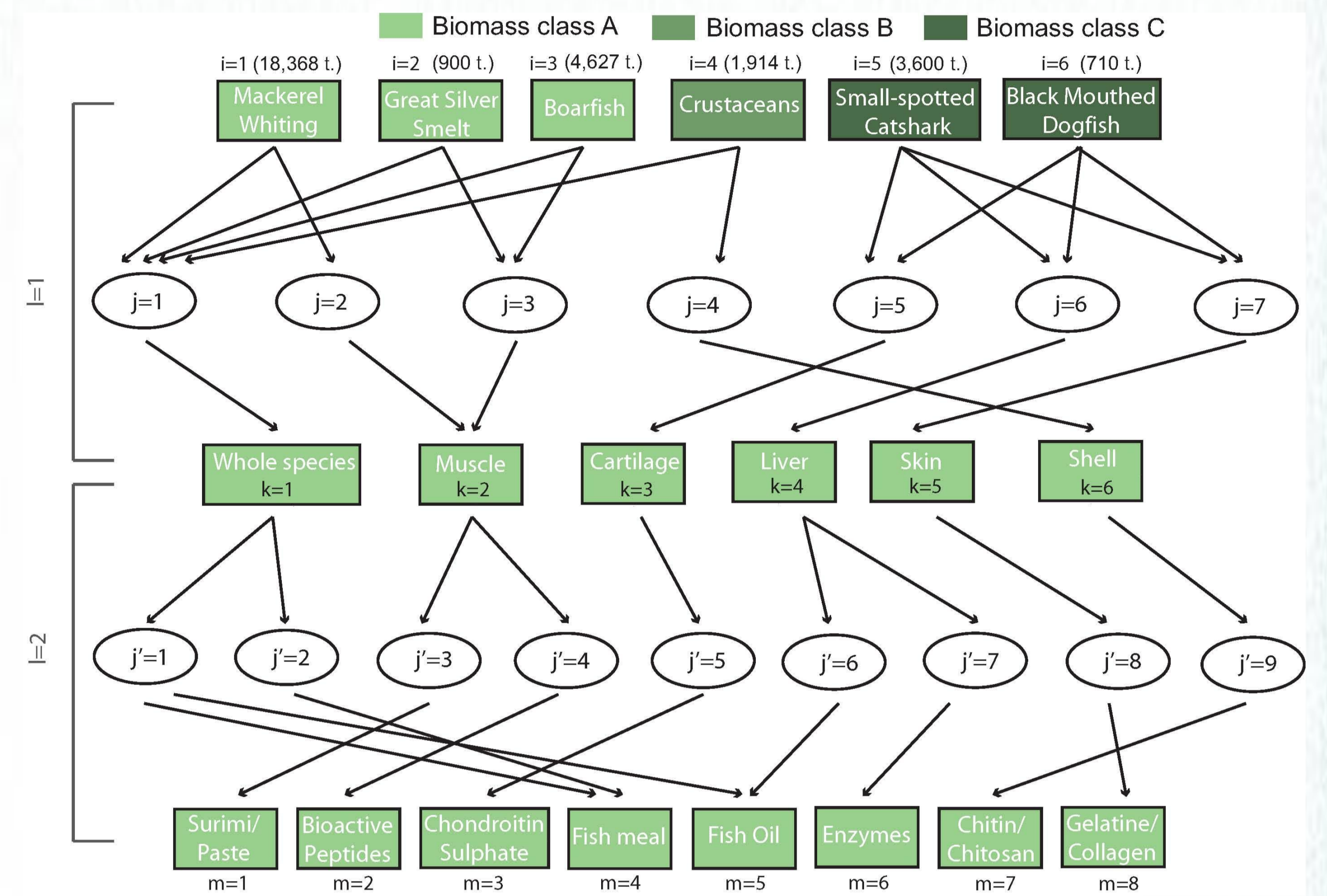
Socioeconomic

Environmental

- CO₂ emissions (electricity /fuel consumption)
- Water consumption
- Waste treatment

OBJECTIVES MUST BE CONSIDERED SIMULTANEOUSLY

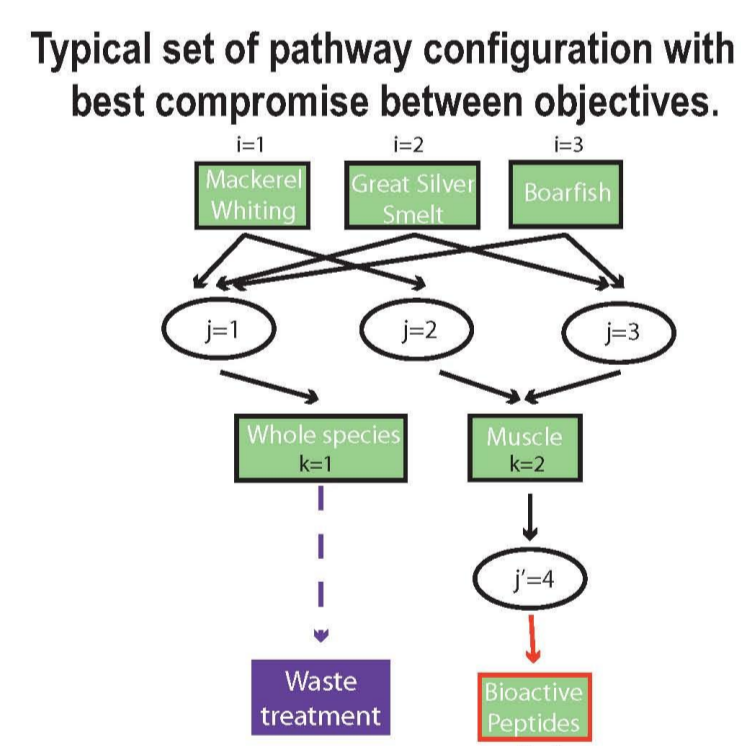
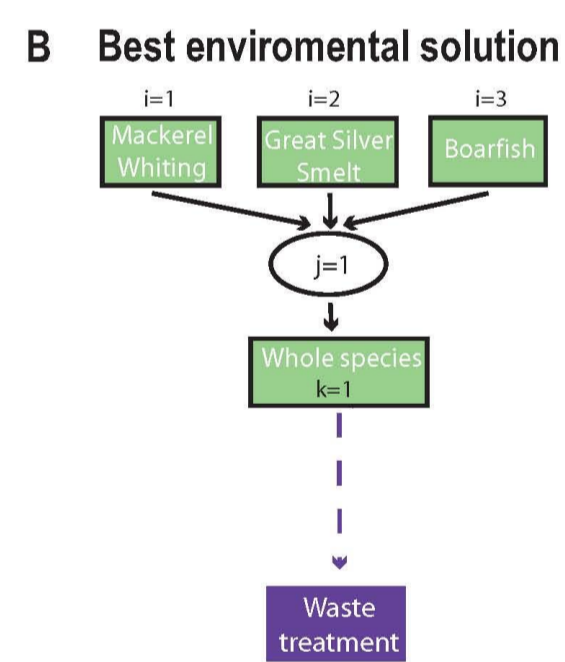
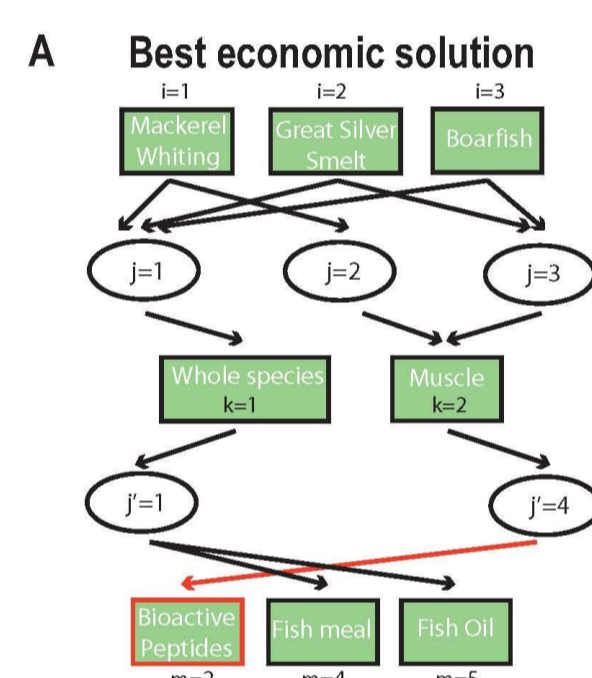
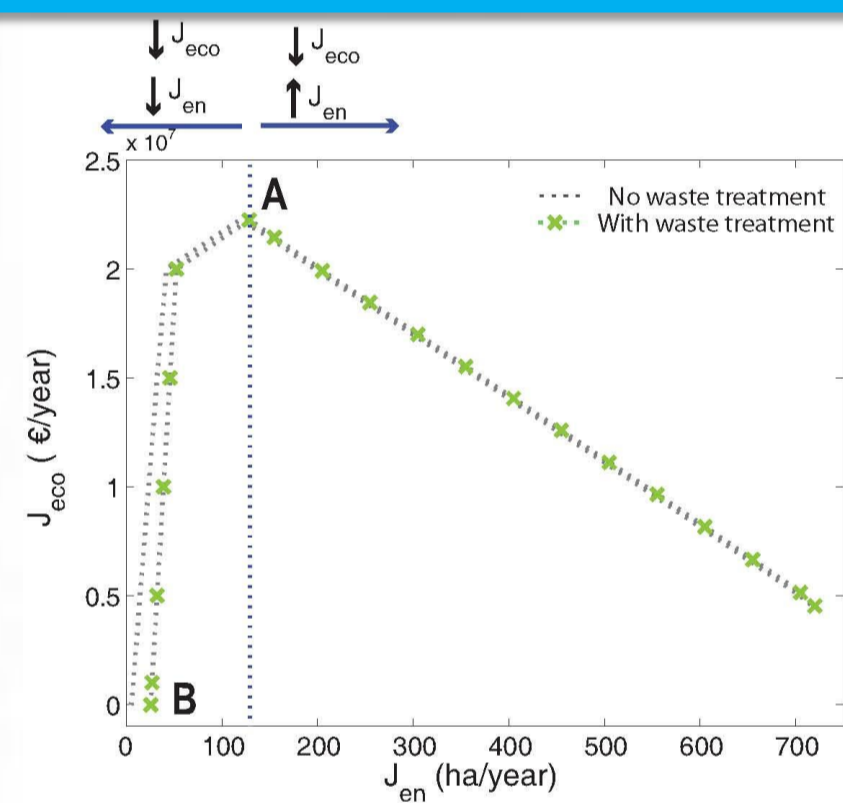
Fishing sector in Galicia (NW Spain) → One of the largest in the European Union.



Pathways analysed for the valorisation of discards (scheme generated using the state of art literature)

RESULTS

Biomass A



Environmental view

- Optimal scenario corresponds to the no processing of biomass.

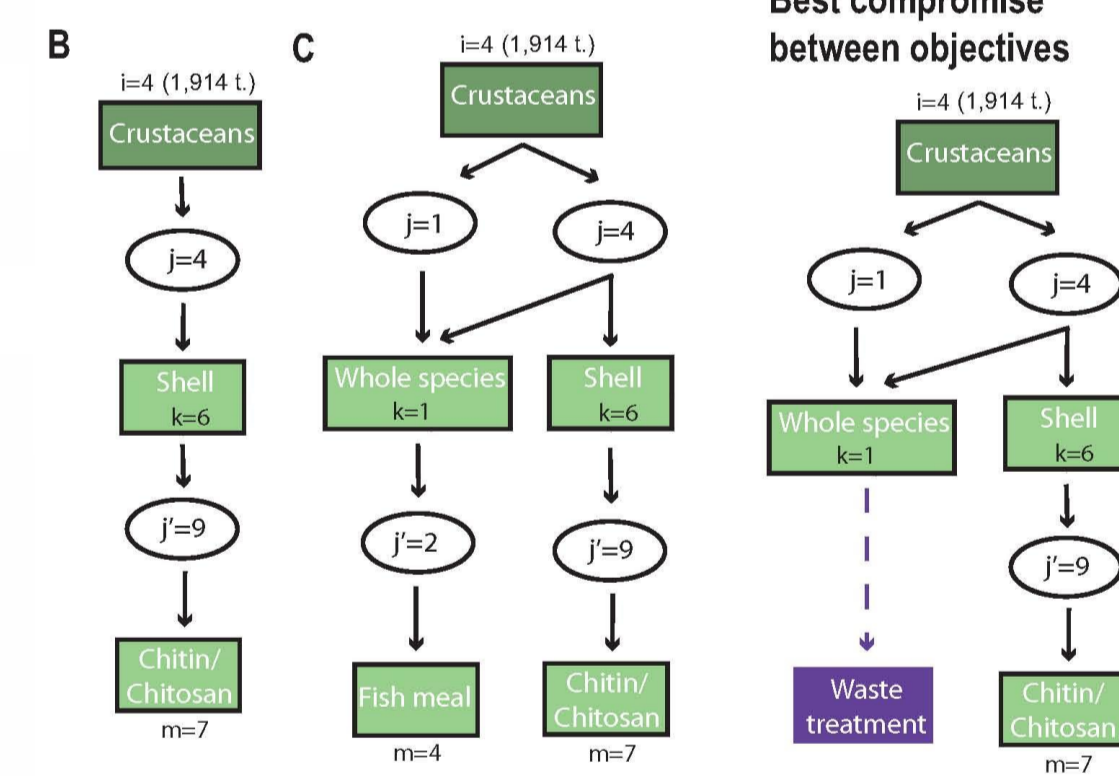
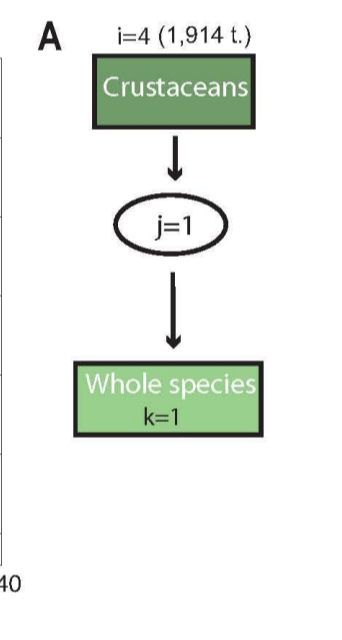
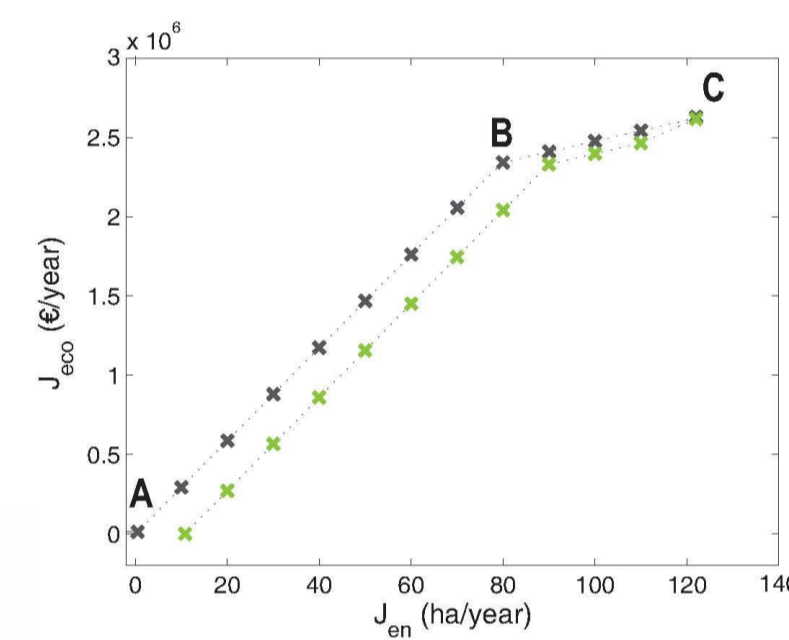
Economic view

- Valorisation of specific fish fractions (muscle)
- Muscle is used to obtain BP at maximum plant capacity.
- Excess of RM is used to produce FM/FO.

Best compromise

- BP and as main products, and the remaining biomass being left as unprocessed muscle.

Biomass B



Environmental view

- No processing of biomass.

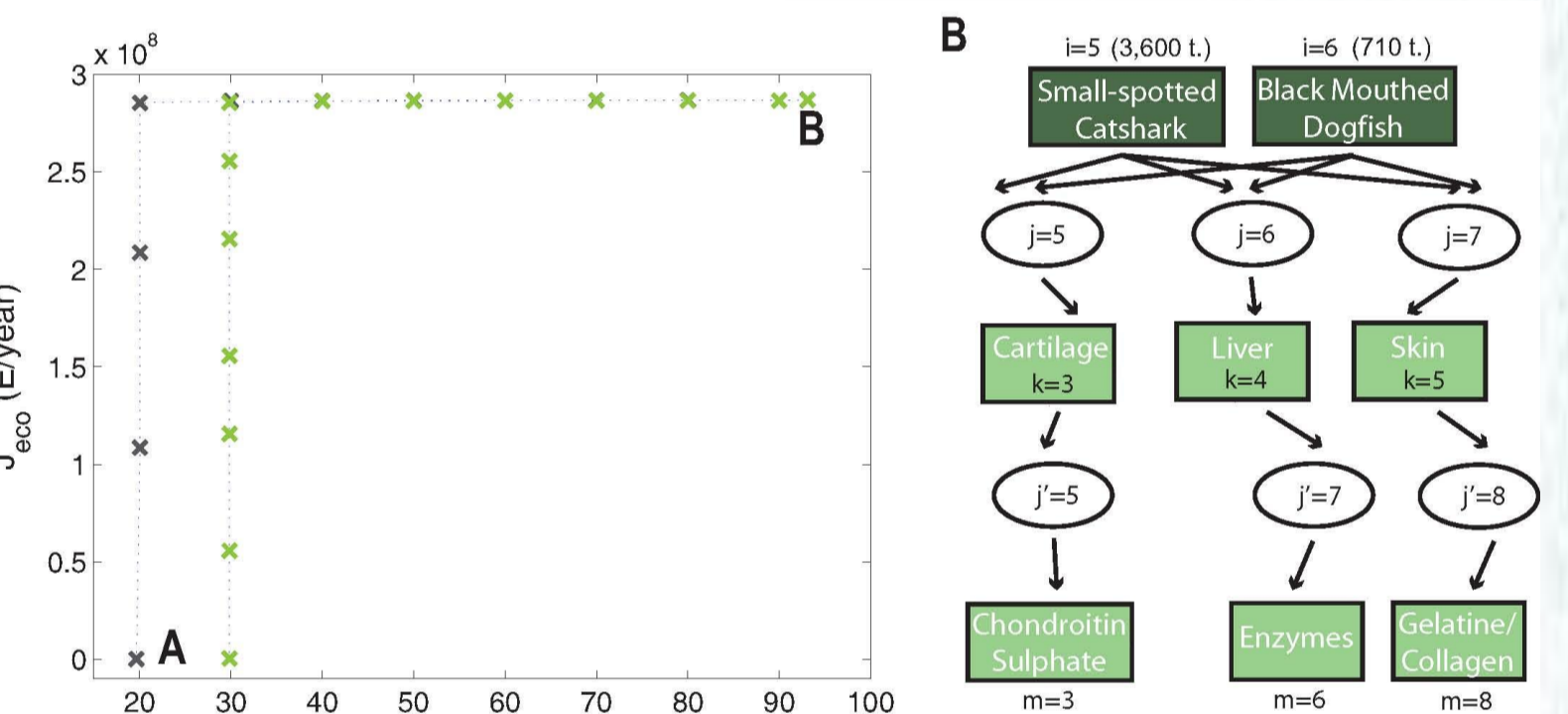
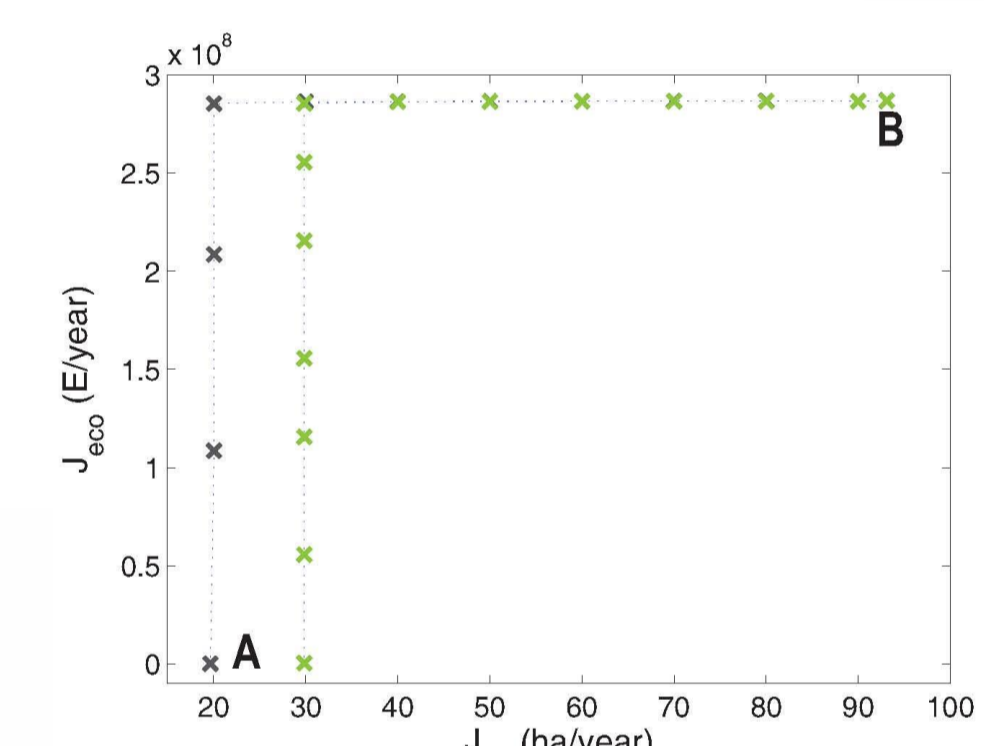
Economic view

- Production of chitin.
- If non-used parts are incorporated to a crustacean meal line, there is an increase on the profit and also on the environmental cost.

Best compromise

- Low chitin production and waste treatment

Biomass C



Environmental view

- Optimal scenario corresponds to the no processing of biomass.

Economic view

- Valorisation of livers (fish viscera) as enzymes and the production of CS and gelatine from cartilage and skin, respectively.

Best compromise

- Transform as much as liver as possible into E and cartilage into CS, and sends the unprocessed material to solid waste treatment.
- Gelatine as final product.

CONCLUSIONS

- In general, the valorisation of **specific fish parts** rather than the use of the whole specimen is more optimal from both points of view.
- Most suitable products: **biopeptides**, **chondroitin sulphate** and **fish enzymes**, due to their high sales price and relative low environmental impact.
- **Alternative technologies** should be considered for the production of **chitin**, **gelatin** and **fishmeal** due to their high environmental cost.
- **Solid waste** must be included in the economic and environmental costs.

RE-DESIGN / ALTERNATIVE TECHNOLOGIES

