Teknisk metode for å skille lettsaltet og fullsaltet torsk

Rodrigo González Reboredo
(ANFACO-CECOPESCA).

FHF Seminar for hvitfiskindustrien. Tromsø (Oct.-2015)

FHF PROJECT: 900985

Teknisk metode for å skille lettsaltet og fullsaltet torsk

Heavy salted

Light salted frozen & Frozen

Light salted chilled

Bacalao

Desalted (Chilled or Frozen)

Re-fresh Cod (Not only Italy...).

Fresh / Chilled

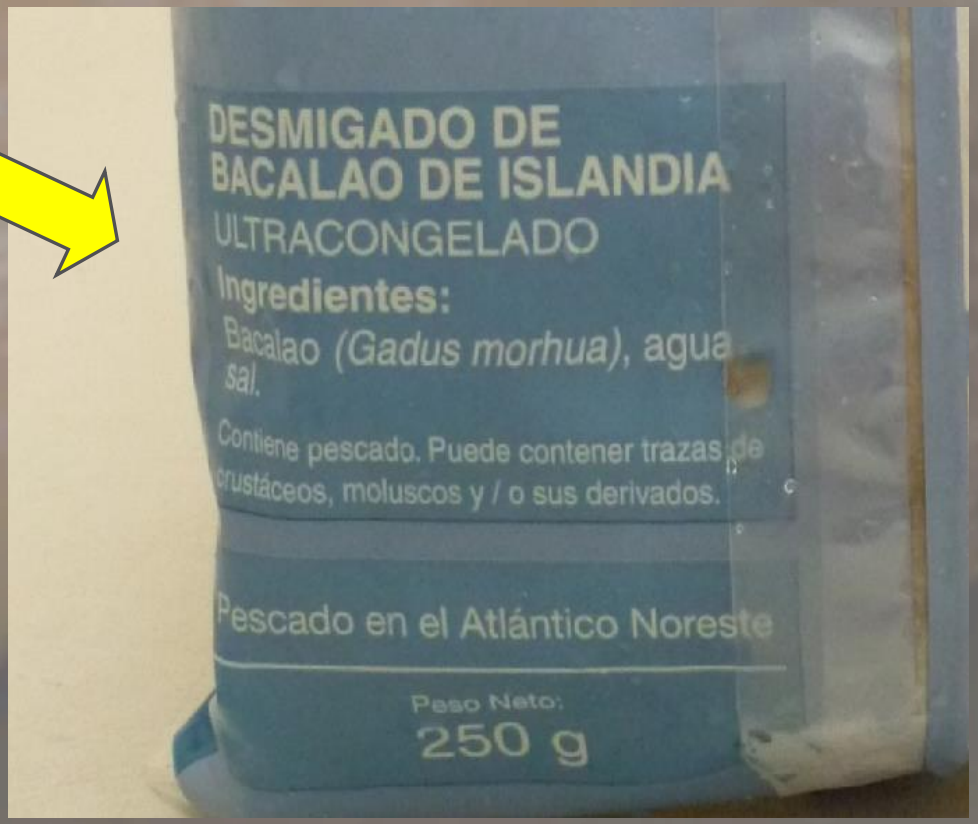
FHF PROJECT: 900985

Teknisk metode for å skille lettsaltet og fullsaltet torsk

Images

MINTEL

Which kind of cod?



Seems light salted, but how does consumer know?

FHF PROJECT: 900985

Teknisk metode for å skille lettsaltet og fullsaltet torsk

Images

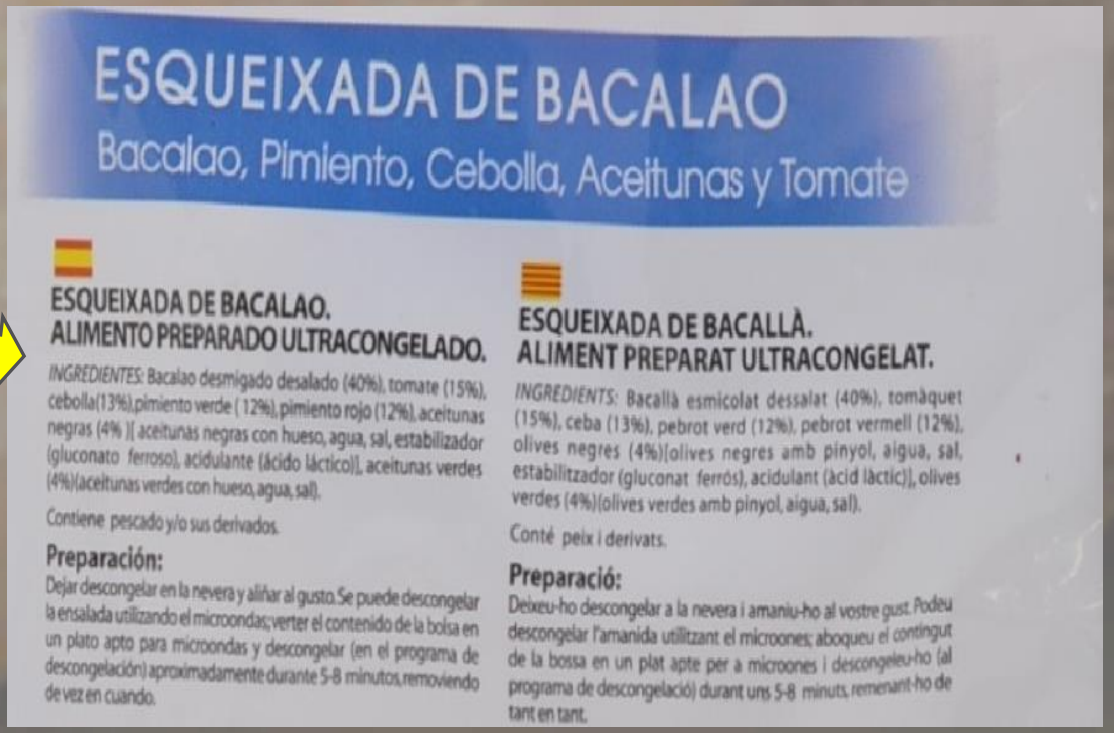
MINTEL

It seems light salted

Teknisk metode for å skille lettsaltet og fullsaltet torsk

Images

MINTEL



Teknisk metode for å skille lettsaltet og fullsaltet torsk

What is going on in the Spanish retail market?

- **What was "bacalao" and what is "bacalao" now?**
- **Do consumers know the differences regarding processing?.**
  - ***Vi har tradisjon for å spise saltfisk. Dagens spanske forbruker har ikke peiling på dette, de er egentlig forvirret. De vet ikke hva det vil si at bacalao er «al punto de sal», saltfisk, utvannet, "fersk" saltfisk eller utvannet og fryst saltfisk.....Og grunnen er at ingen har informert publikum om dette. (Spanish importer - From FHF project: 900110).***

Why would consumers pay more for something they do not know?

- **Misinformation ---- Mistakes in purchase (no reward) - Affects bacalao consumption**
- **It is necessary to enhance consumer knowledge. Need of appropiate consumer information:**
  - ***Jeg mener det har blitt veldig viktig å iverksette opplysningsarbeid for å vise spanske forbrukere hvilke alternative torskeprodukter som finnes i dag: Fersk torsk, lettsaltet og fryst torsk, utvannet saltfisk og tradisjonell saltfisk. Man må slutte å lure folk!" (Spanish importer - From FHF project 900110).***

Teknisk metode for å skille lettsaltet og fullsaltet torsk

What is going on in the Spanish retail market?

In the absence of specific regulation and control, consumers are exposed to unfair practices by producers or misleading omissions in labelling.

Development of methodologies for the surveillance of cod products authenticity

Development of specific market regulation for cod products

SALDICOD project: ***Development and implementation of technical criteria for the differentiation of light salted vs. fully salted/desalted cod products. How to disseminate appropriate information and avoid misleading consumers.***

- **Stage 1: Sampling**
- **Stage 2: Preliminary characterization and screening of techniques**
- **Stage 3: Selection of best techniques. Methods optimization and validation.**
- **Stage 4: Development of SOP and technical documents. Dissemination of project results.**

FHF PROJECT: 900985

Teknisk metode for å skille lettsaltet og fullsaltet torsk

Sampling:

Gather as much variance as possible in order to test the method performance in all conditions:

- **Industry samples:** Simulation of real conditions in cod production:

Desalting

72 h – 2 - 4ºc .
3 water changes

Defrosting

48 h – 2 - 4ºc .
Air defrost.

Packing

MAP / VP / VP+ HPP

Market Shelf life

CHILLED : UP TO 14 DAYS

FROZEN : UP TO 4 MONTHS

- **Market samples:** Real samples in Spain and Italy combining qualities, producers, origin, etc...

Teknisk metode for å skille lettsaltet og fullsaltet torsk

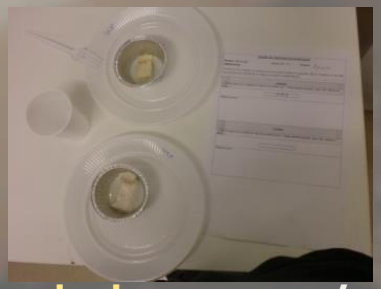
Stage 1: Sampling and comparative characterization of light salted and desalted cod.

Physical-Chemical - Microbiological:

- **Lots of analysis carried out (Nutritional facts, minerals, nitrogenous compounds, freshness, oxidation, texture, microbiological studies, … etc…).**
- **A lot of parameters seem discriminant in industry samples but not in market samples (pH, WHC, potassium , phosphorus levels, texture,….) due to additives, shelf-life ,….**
- **Very important loss of non-protein nitrogenous compounds (taurine, creatine, trimethylamine oxide, anserine) along cod processing. More prominent during heavy salting – desalting stages.**

Sensorial:

Test



Pannel could not differentiate between light salted and desalted as raw *(only 6/11 - duo-trio test).*

In cooked product, the pannel was able to discriminate samples (10/11 - duo-trio test) mainly because of a more intense flavour and harder texture.

Pannel did not show a preference for light salted cod or desalted cod (either raw or cooked).

Teknisk metode for å skille lettsaltet og fullsaltet torsk

Stage 2: Screening of techniques for the discrimination of light salted and desalted cod.

- Different techniques were tested. Methods specially developed for the analysis of cod materials.
- *Methods need to be simple, accurate/precise/robust, fast, easy to incorporate by other laboratotries and use available instrumental .*

Results not fully discriminant or affected by other factors.

Results fairly discriminant but cannot be easily disseminated.

Discriminant results. Methods meeting project objectives.

- Microbial Phenotype Microarray Characterization of the microbiota.
- Electronic nose.
- FTIR
- Colorimetric analysis:

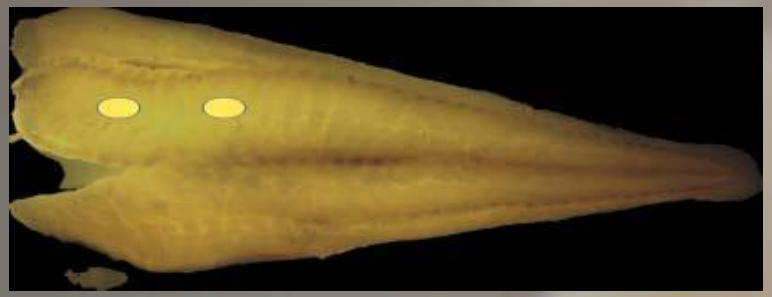
- Molecular biology tools to determine microbial fingerprinting in cod products (T-RFLP).
- Determination of TMAO+TMA in cod products.
- Determination of taurine in cod samples by HPLC-FLD.
- Determination of creatine, anserine and carnosine in cod muscle by HPLC/UV
- Determination of the microstructure of cod samples by optic microscopy.
- Determination of the protein profile of the cod samples by SDS-PAGE.

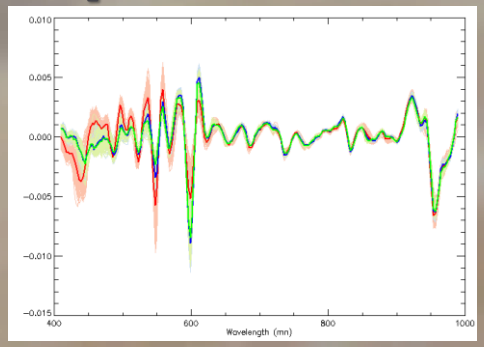
- Hyperspectral imaging of cod samples.

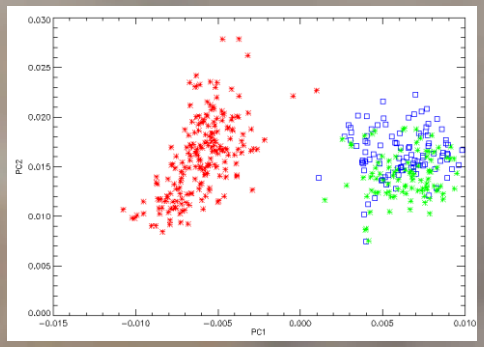
- Analysis of cod samples using a machine vision system.

Teknisk metode for å skille lettsaltet og fullsaltet torsk

Hyperspectral imaging of cod samples.







- **Models developed only with industrial samples showed very good discriminant results:**
  - **Light salted vs. Desalted** *(99,9% correctly classified)*
  - **Light salted (Frozen raw materials) vs. Light salted (Fresh raw materials).** *(93,3% correctly classified)*

- **When introducing market samples:**
  - **Bigger variation than previously tested industrial samples. Number of market samples were less than 10% of the number of industrial samples.**

Table 5 Confusion matrix when classifying industrial samples using absorbance spectra with and without preprocessing

	Preprocessing / Performance		Predicted product type: Lightly salted	Predicted product type: Heavily salted
True product type	Absorbance spectra 99,4% correct classification	Lightly salted	99,3%	0,7%
		Heavily salted	0,5%	99,5%
	SNV preprocessed spectra 99,4% correct classification	Lightly salted	99,5	0,5%
		Heavily salted	0,6%	99,4%
	First derivative spectra 99,7% correct classification	Lightly salted	99,5%	0,5%
		Heavily salted	0,0%	100,0%
	Second derivative spectra 99,6% correct classification	Lightly salted	99,3%	0,7%
		Heavily salted	0,0%	100,0%

Confusion matrix when classifying industrial samples

Confusion matrix when classifying market samples using absorbance spectra with and without preprocessing and a PLS-classifier

	Preprocessing / Performance		Predicted product type: Lightly salted	Predicted product type: Heavily salted
True product type	Absorbance spectra 93,1% correct classification	Lightly salted	90,7%	9,3%
		Heavily salted	4,4%	95,6%
	SNV preprocessed spectra 94,0% correct classification	Lightly salted	89,7	10,3%
		Heavily salted	1,6%	98,4%
	First derivative spectra 93,9% correct classification	Lightly salted	90,1%	9,9%
		Heavily salted	2,2%	97,8%
	Second derivative spectra 93,6% correct classification	Lightly salted	89,5%	10,5%
		Heavily salted	2,2%	97,8%

Confusion matrix when classifying market samples

Promising results that could be improved including a larger market sample set .
Method not selected for optimization due to low potential of fast incorporation by other laboratories.

FHF PROJECT: 900985

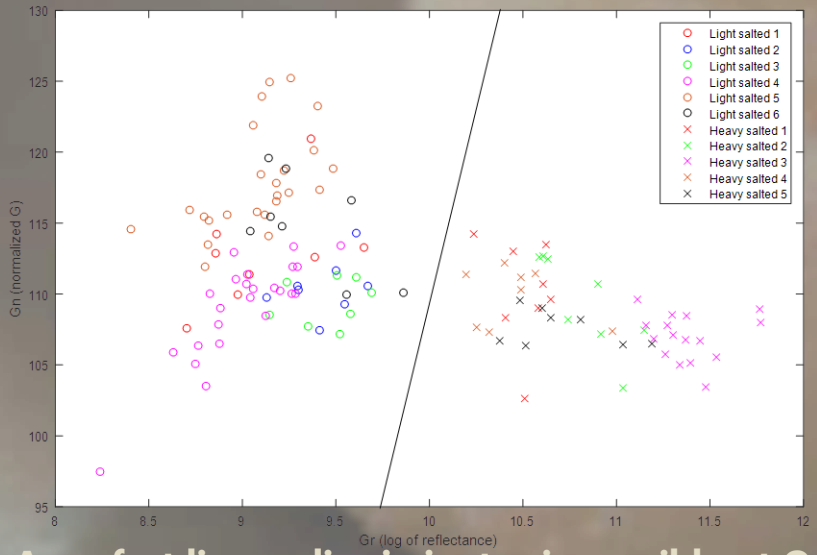
Karsten Heia (NOFIMA).

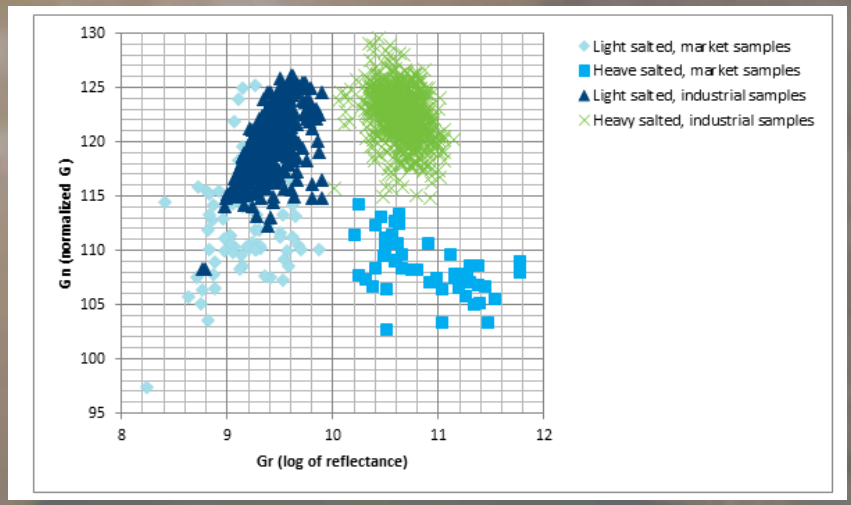
Teknisk metode for å skille lettsaltet og fullsaltet torsk

Machine vision system

Characterization of subsurface muscle structure by fluorescence scatter imaging using a near-UV polarized laser.

- **Models developed in industry samples showed nearly perfect discrimination (99,9%) of light salted and desalted cod samples.**
- **Market samples were not tested as an external validation set. Method was validated using cross-validation.**





- **A perfect linear discriminator is possible at Gr = 10, although verification of these good results is only possible by first developing a consistent and reproducible measurement hardware and second acquiring measurements on a new data set of both industrial and market samples.**

FHF PROJECT: 900985

J. Reidar Mathiassen (SINTEF).

Teknisk metode for å skille lettsaltet og fullsaltet torsk

Stage 3: Selection of best techniques. Methods optimization and validation.

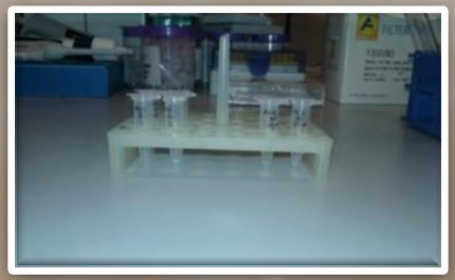
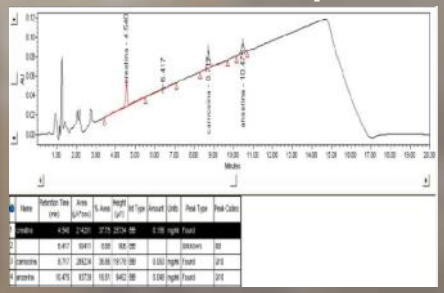
➢ Determination of TMAO+TMA in cod products.

Method based on the studies from Parkin & Hultin (1982).



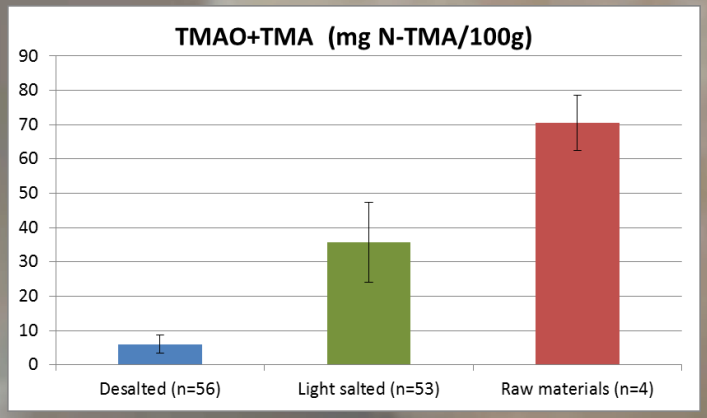
➢ Determination of creatine in cod products.

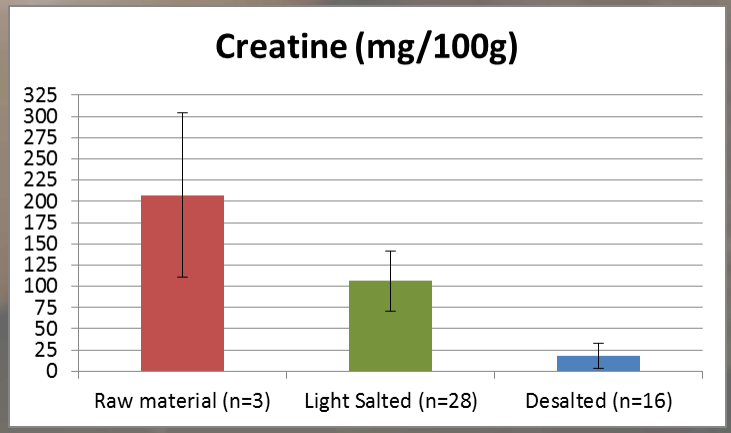
HPLC/UV method adapted from Mora et al. (2007) in pork.

Original only in the application of results not from an analytical point of view. Successfully validated: Robust, accurate, precise, sensitive.

Differences in contents of raw materials, light salted cod and desalted cod.





A discriminant threshold can be set at 12 mg TMAO+TMA /100g and 40 mg creatine /100g although it should be more thoroughly established with a larger set of samples.

Standard Operating Protocols have already been prepared for dissemination.

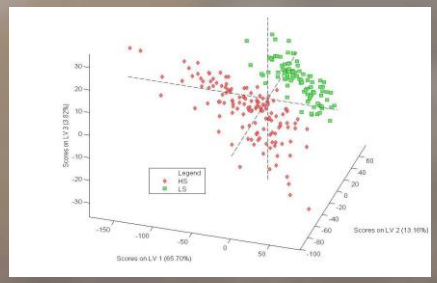
FHF PROJECT: 900985

Teknisk metode for å skille lettsaltet og fullsaltet torsk

Stage 3: Selection of best techniques. Methods optimization and validation.

➢ **FTIR authentification of cod products.**

Low sample volume . Minimal sample preparation. High speed. Very low cost. *High initial effort of developing the model.* (more than 200 samples were used). Only *Gadus morhua* samples.



Discrimination of the samples was perfect in the cross validation of the training set and with samples from the same producers/ batches as an external test set.

Testing 30 samples of 9 producers showed evidence of misleading practices that the model was able to detect. The performance of the model was satisfactory (>90%) but the models should be further reinforced with more market samples variance.

Actual class	Predicted as HS	Predicted as LS	% Correct
HS	138	0	100
LS	0	92	100
		Tot. correct (%)	100

Table 6. Validation confusion matrix of test set containing samples from producers not present in the training set

Actual class	Predicted as HS	Predicted as LS	% Correct
HS	28	0	100
LS	0	28	100
		Tot. correct (%)	100

Models could be developed in commercial FTIR instrumental available at control laboratories incorporating the SOP that has been prepared for dissemination.

FHF PROJECT: 900985

Marco de Rubeis, ,A. Serio, A.Paparella.

Teknisk metode for å skille lettsaltet og fullsaltet torsk

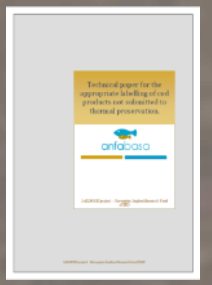
Stage 4: Dissemination of project results.

Development of Standard Operating Procedures (SOP):

SOP will be free and fully available to control laboratories and industry

Collaborative intervalidation studies with official laboratories.

- **Dissemination of project results through scientific papers. Participation in scientific / industrial forums.**
- **Lobbying for a better definition of cod products in the market.**
  - **Development of papers discussing technical and legal issues. Quality Standard Proposal.**
  - **Direct contact to the Authorities. (AECOSAN-MAGRAMA. Meeting Madrid - 13th Oct., 2015).**
  - **Issue the topic through AIPCE.**



- **Desing of a common campaign for the appropiate information of cod products to consumers.**
  - **Contact to national Associations in the market countries. ANFABASA (Spain), ASSOITTICA (Italy) and AIB (Portugal).**
  - **Potential collaboration of the Norwegian Seafood Council in Italy, Spain and Portugal.**

Takk for oppmerksomheten

INVESTMENTS AND NEW FACILITIES

Located at the University of Vigo Campus, ANFACO-CECOPESCA has a plot of 6,000 m² with two buildings, one administrative and other scientific and technical, and the new Advanced Technology Center for Marine and Food Industry Research, which is under construction. It has the most advanced equipment and cutting-edge technologies for Marine and Food Research.

▲ Centre of Excellence Marine-Industry Complex

8,5 M€
of investment.
2,1 M€ of investment in 2014 in infrastructures and scientific-technological equipment.

5.800 m²
Area

2014/2015
Execution period

Takk for oppmerksomheten