

Seafood authentication: DNA reference database

Platichthys flesus	European flounder	FLE	127141	Pleuronectidae	PL	
Clupea harengus	Atlantic herring	HER	126417	Clupeidae	CLUPEI	
Oncorhynchus mykiss	Rainbow trout	TRR	127185	Salmonidae	Salmoniformes	
Pleuronectes platessa	European plaice	PLE	127143	Pleuronectidae	PLEURONECTIFORMES	7
Solea solea	Common sole	SOL	127160	Gobiidae	PLEURONECTIFORMES	7
Sprattus sprattus	European sprat	SPR		Clupeidae	CLUPEIFORMES	7
Trachurus trachurus	Atlantic horse mackerel	HOM	12682	Carangidae	PERCOIDEI	7
Gadus morhua	Atlantic cod	COD	126436	Gadidae	GADIFORMES	6
Salmo trutta	Sea trout	TRS	127187	Salmonidae	Salmoniformes	6
Salvelinus fontinalis x Salvelinus alpinus	Sparctic - hybrid species			Salmonidae	Salmoniformes	6
Scomber scombrus	Atlantic mackerel	MA	12683	Scombridae	SCOMBROIDEI	6
Limanda limanda	Common dab	DA	127139	Pleuronectidae	PLEURONECTIFORMES	5
Sardina pilchardus	European pilchard (=Sardine)	SA	126421	Clupeidae	Clupeiformes	5
Chirocentrus	Thicklip grey mullet	LR	126977	Mugilidae	MUGILIFORMES	4
Chirocentrus	Pouting	BIB	126445	Gadidae	GADIFORMES	4
	Bream	FBM	154281	Cyprinidae	Cypriniformes	3
	Sea bream	GUR	127259	Triglidae	SCORPAENIFORMES	3
Chelidonichthys lucerna	Sea bream	GUU	127262	Triglidae	SCORPAENIFORMES	3

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SUMMARY

DNA-based methods increasingly play a role in food safety control and food corruption detection. A new reference database has been developed which contains 300 high-quality DNA sequences for 42 European commercially important seafood species. These sequences are linked to digital images which can then be used to verify morphological characteristics and relevant metadata. The database is open access, which will enable further research in the area as well as its use as an education tool to train students in DNA barcoding techniques. The database can also be used by the food industry and regulatory agencies to ensure reliable identification of fish species in processed seafood, supporting better transparency in seafood authentication.



KNOWLEDGE NEED

The fraudulent substitution of seafood species and mislabelling of products puts consumers at risk of allergic reaction and other ailments, and has detrimental effects on the seafood industry. DNA barcoding is a popular technique that makes it possible to identify mislabelling, even of highly processed food products. This method relies on having access to correct and complete databases that link the found DNA sequence to the correct species names. However, many public DNA databases contain erroneous sequences which are paired with incorrect species names. When used as a control tool for processed seafood, a comprehensive and correct DNA reference database is required, which contains European fishes commercially available to consumers.



RESULTS

This output comprises the reference database of high-quality expertly verified DNA sequences of fish species, for which digital pictures are available to verify morphological characters. Sequences are linked to all relevant metadata, including storage of tissue and DNA extracts, origin of the specimens, lab protocols, and digital pictures. This provides reference sequences with 100% reliable species names attached, which is essential for accurate identification of processed food samples. Database contents were validated using phylogenetic inference, to identify similarities between sequences from the same species, collected by different partners. In addition, the applicability of the sequences for DNA barcoding was justified via barcode gap analysis, which showed a clear distinction of genetic distances within and between species.

IMPACTS



Industry-wide implementation of the DNA techniques will ensure the availability of reliable and safe seafood products on the market. This DNA reference database will support the development of such tools for more efficient monitoring, at lower cost, enabling the delivery of higher quality and authentic products that help to increase consumer trust.

Contributes to the UN Sustainable Development Goal 12: Responsible consumption and production.

END-USERS & APPLICATIONS

- ➔ **Scientific community – researchers:** can use the validated DNA reference database to support further Research and Development of genetic and molecular tools to support seafood authenticity.
- ➔ **Scientific community – educators:** can use the extensive open access reference tool as an educational resource and to support further research in DNA barcoding.
- ➔ **Industry organisations – food producers/processors:** Quality control laboratories such as state monitoring agencies and producers/processors along the supply chain can use the reference database to monitor correct labelling of seafood.
- ➔ **Environmental managers and monitoring agencies:** managers and monitoring agencies associated with the seafood industries can use the database to ensure more reliable identification of processed seafood.

DISSEMINATION AND EXPLOITATION

Dissemination activities for society / all users:

- Traditional media coverage in Belgium, including:
 - news articles: De Gazet van Antwerpen, Het belang van Limburg
 - TV and radio interviews: radio1.be/programma/nieuwe-feiten/radioitem/tong-niet-altijd-tong/21354
 - documentary: plattelandstv.be/videos/boerenstebuiten/ilvo-visfraude-opsporen-dna
- Promotion on Twitter and LinkedIn
- Project newsletter and news articles
- Video tutorial: drive.google.com/open?id=1B8rnQTgGPMDt6iJYe-GB1jV379zRiYlv

Exploitation activities for seafood industry:

- **SEAFOOD^{TOMORROW}** eLearning course – unit 4: opentea.eu/en/e-learning/courses-Creating-nutritious-safe-and-sustainable-seafood-for-consumers-of-tomorrow.29
- Horizon Results Platform: seafoodtomorrow.eu/horizon-results-platform

Dissemination activities for scientific community:

- Deconinck D, Volckaert FAM, Hostens K, Panicz R, Eljasik P, Faria M, Monteiro CS, Robbens J, Derycke S. (2020). A high-quality genetic reference database for European commercial fishes reveals substitution fraud of processed Atlantic cod (*Gadus morhua*) and common sole (*Solea solea*) at different steps in the Belgian supply chain. *Food and Chemical Toxicology*, 139, 111471. DOI: 10.1016/j.fct.2020.111471.
- Open access version: zenodo.org/record/3865408#.YEosaZ37TIV
- Presentations at conferences, workshops and event for e.g. VLIZ Marine Science Day 2020

Exploitation activities for policy makers:

- Managers, regulators and policy makers will be reached through the final **SEAFOOD^{TOMORROW}** event, EC info session, and a dedicated EU policymakers' meeting (March – April 2021).



INNOVATION STATUS

Technology Readiness Level 9 – available for use

Open-access database: seafoodtomorrowdata.eu/authentication

Patents and IPR: Not applicable



FUTURE RESEARCH

The database is accessible from the **SEAFOOD^{TOMORROW}** project website and can be indefinitely updated with new specimens and DNA sequences.

CONTACT AND CONTRIBUTORS

Contact: Sofie Derycke, sofie.derycke@ilvo.vlaanderen.be | Miguel Faria, ICETA, mfaria@ff.up.pt | Remigiusz Panicz, Remigiusz.Panicz@zut.edu.pl

Contributors: ICETA, ILVO, ZUT, BFD

