

COCKLES

Co-Operation for Restoring Cockle Shellfisheries
and its Ecosystem-Services in the Atlantic Area

Parasites: Good or not good ? – Part II:
The catalogue of parasites and diseases of
the common cockles *Cerastoderma edule*

Presentation Xavier de Montaudouin, University of Bordeaux

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FINAL VIRTUAL CONFERENCE

March 2021





**CATALOGUE OF
PARASITES AND DISEASES
OF THE COMMON COCKLE**
Cerastoderma edule



**CATÁLOGO DE
PARASITAS E PATOLOGIAS
DO BERBIGÃO-VULGAR**
Cerastoderma edule



**INVENTARIO DE
PARASITOS E ENFERMIDADES
DO BERBERECHO**
CERASTODERMA EDULE



**ATLAS:
PARASITES ET MALADIES
DE LA COQUE COMMUNE**
CERASTODERMA EDULE



*Lazy or timeless readers who wouldn't read the whole introduction should however courageously reach the end of this sentence: 1) none of the parasites/diseases of cockles (*Cerastoderma edule*) is harmful for human consumers; 2) parasites are part of the biodiversity; and 3) some (few) parasites/diseases are dramatically deleterious at their host population scale.*



*Os lectores preguiceiros ou os que dispoñan de pouco tempo para ler toda a introdución deberían, en todo caso, facer un esforzo por chegar ao final deste parágrafo: 1) ningún dos parasitos ou enfermidades que afectan aos berberechos (*Cerastoderma edule*) é nocivo para o consumidor humano; 2) os parasitos forman parte da biodiversidade; e 3) algúns (poucos) parasitos ou enfermidades son tremendamente daniños para a súa comunidade hospedadora.*



*Os leitores ociosos ou sem tempo que não leiam a totalidade da introdução devem, contudo, ler a frase seguinte até ao fim: 1) nenhum dos parasitas/patologias dos berbigões (*Cerastoderma edule*) é prejudicial para o consumo humano; 2) os parasitas fazem parte da biodiversidade; e 3) alguns (poucos) parasitas/patologias são altamente nocivos à escala da população dos seus hospedeiros.*

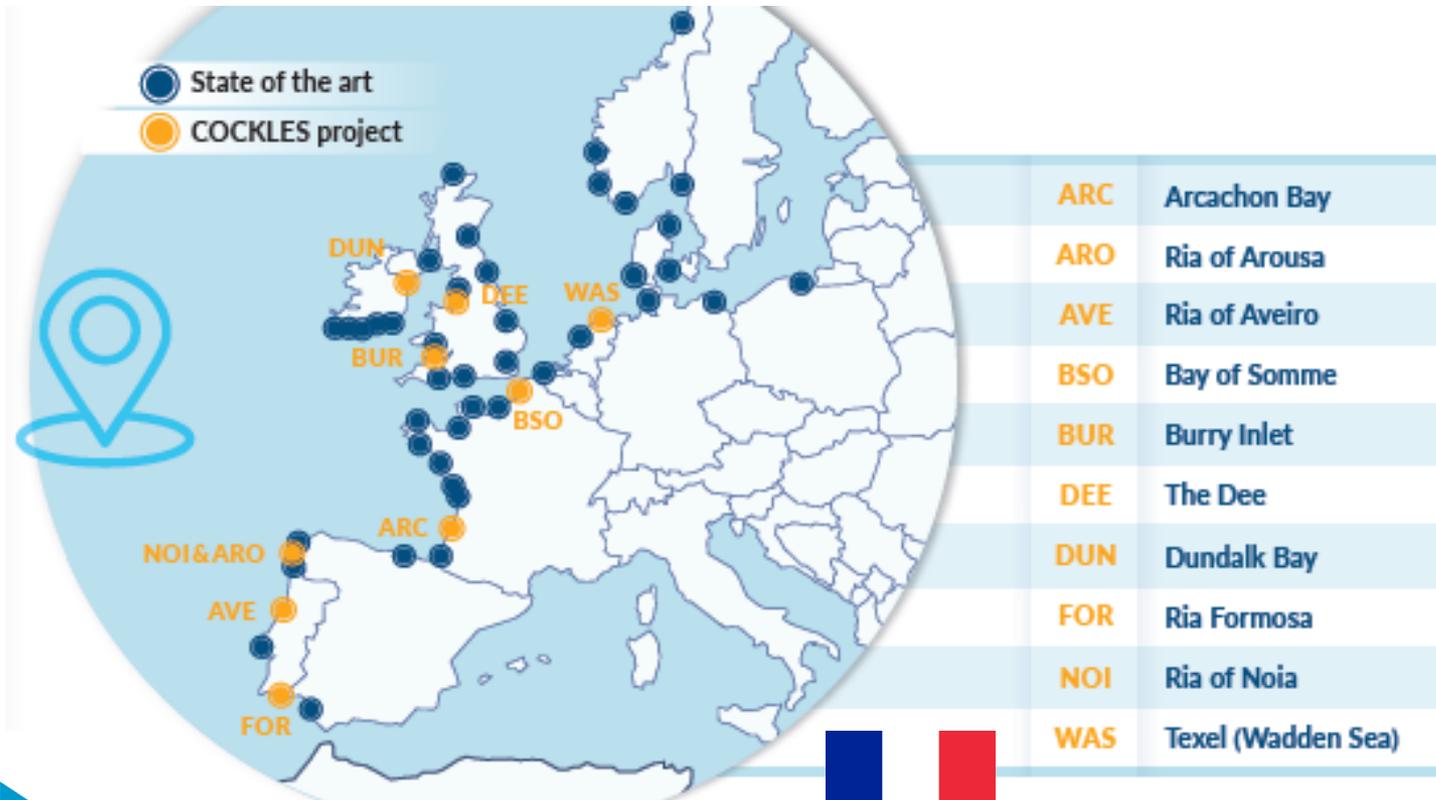


*Les lecteurs paresseux ou pressés, peu susceptibles de lire l'intégralité de l'introduction, devraient cependant s'armer de courage pour lire cette phrase jusqu'à la fin : 1) les parasites/maladies des coques (*Cerastoderma edule*) ne représentent pas de danger pour les consommateurs 2) les parasites font partie de la biodiversité et 3) quelques parasites ou maladies (une faible quantité) sont nuisibles à l'échelle de leur population hôte.*



Where are the parasites?

Onde estão os parasitas?

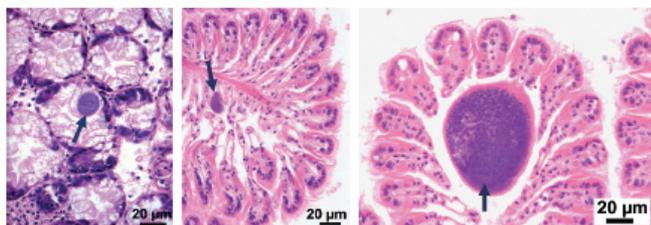


Onde están os parasitos?

Où sont les parasites?

BACTERIA

LATIN NAME *Endozoicomonas*-like organisms
SYNONYMS None
COMMON NAME Bacterial microcolonies
CLASSIFICATION Proteobacteria – Oceanospirillales



General Description

Bacterial microcolonies have been reported in numerous marine mollusc species. They were usually referred as Rickettsia-like organisms (RLO) but molecular phylogenetic analyses demonstrate they belong to widely diverse bacterial groups. In *Cerastoderma edule*, basophilic bacterial microcolonies occur mostly in the epithelia of the digestive diverticula and the gills and, occasionally, in the connective tissue of the man-

tle and labial palps. The colonies are usually intracellular although, in the gills, mantle and labial palps, they can evolve to large extracellular cysts surrounded by a fibrous cover that, eventually, can break, thus shedding bacteria. Recent molecular phylogenetic analysis showed that the bacterial microcolonies of cockles correspond to *endozoicomonas*-like organisms.

Individual Pathogenicity

Detrimental effects due to bacterial microcolonies have not been reported in cockles but heavy infections with bacterial microcolonies have been associated with poor condition and even being lethal in other bivalve species.

Populational Pathogenicity

There are no reports of cockle mortality events or population decline associated with bacterial microcolonies.

Distribution Map in the Atlantic Area (signalisation)



Diagnosis Techniques

- **Histology:** Basophilic bacterial microcolonies with variable shape and size are observed within epithelial cells of digestive diverticula or in gills. Large extracellular colonies surrounded by a fibrous cover can be observed in the gills and, rarely, in the connective tissue of mantle and labial palps.
- **Expertise laboratories/Contacts in the COCKLES AA consortium:** [2], [5], [10], [15], [20], [D].

Risks in the Atlantic Area (AA)

- **Actual situation:** Unknown.
- **Related to trading:** Unknown but no risk for human consumption.
- **Global change:** Unknown.

Advices

Cockles from areas known to be infected should not be transferred to areas with no record of bacterial microcolonies. No action in nature conservation areas.

Relevant References

Azevedo 1993; Carballal et al. 2001; Elliot et al. 2012; Longshaw & Malham 2013; Cano et al. 2020.

SCIENCE



EDUCATION



« ACTORS »
(Fishermen,
stakeholders, Policy
makers, ...)





Which taxa?



Que táxones?



Que taxons?



Quels taxons?

ARTHROPODA

COPEPODA

- *Herrmannella rostrata* (p. 96)
- *Mytilicola orientalis* (p. 98)

DECAPODA

- *Afropinnotheres monodi* (p. 100)
- *Pinnotheres pisum* (p. 102)

PLATHYHELMINTH

TREMATODA

- *Asymphilodora demeli* (p. 50)
- *Bucephalus minimus* (p. 52)
- *Curtuteria arguinae* (p. 54)
- *Diphtherostomum brusinae* (p. 56)
- *Gymnophallus choleadochus* (p. 58)
- *Gymnophallus somateriae* (p. 60)
- *Himasthla continua* (p. 62)
- *Himasthla elongata* (p. 64)
- *Himasthla interrupta* (p. 66)
- *Himasthla quissetensis* (p. 68)
- *Monorchis parvus* (p. 70)
- *Parvatrema fossarum* (p. 72)
- *Parvatrema minutum* (p. 74)
- *Psilostomum brevicolle* (p. 76)
- *Renicola roscovitus* (p. 78)
- Unknown metacercaria (p. 80)

CESTODA

- *Trypanorhynchia* (p. 82)

TURBELLARIA

- *Paravortex cardii* (p. 84)

NEMATODA

- *Malacobdella grossa* (p. 92)

OTHER DISEASES

- Disseminated neoplasia (p. 106)
- Granulomatosis (p. 108)
- Picornaviral-like disease (p. 110)



BACTERIA

- *Endozoicomonas*-like (p. 12)
- *Vibrio aestuarianus* (p. 14)
- *Vibrio tapetis* (p. 16)

FUNGI

MICROSPORIDIA

- *Hyperspora aquatica* (p. 20)
- *Steinhausia*-like (p. 22)
- *Unikaryon legeri* (p. 24)

CHROMISTA

ALVEOLATA

- *Eucoccidiorida* (p. 28)
- *Nematopsis* sp. (p. 30)
- *Perkinsus* spp. (p. 32)
- *Rynchođáda*-like (p. 34)
- *Trichodina* spp. (p. 34)

RHIZARIA

- *Haplosporidium edule* (p. 36)
- *Minchinia mercenariae* (p. 38)
- *Minchinia tapetis* (p. 40)
- *Urosporidium* sp. (p. 42)
- *Marteilia cochillia* (p. 44)





Where is the expertise?



Quem são os especialistas?



Onde están os expertos?

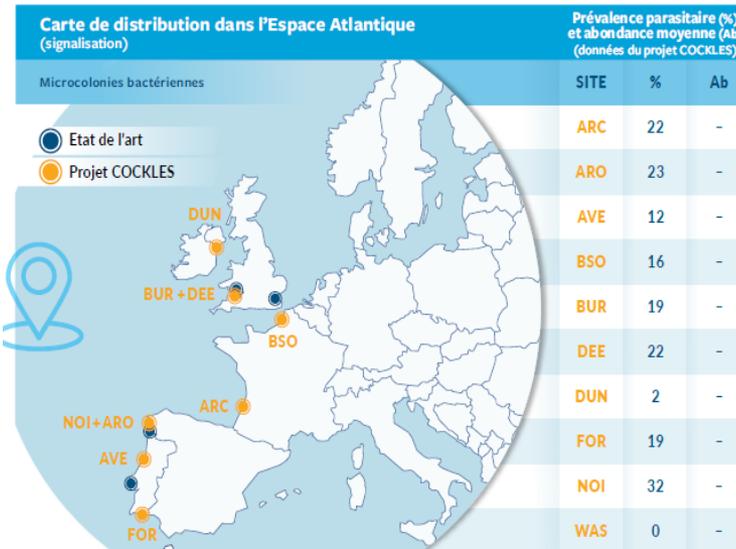


Où est l'expertise?

- [2] CIMA-XUGA (Contact: antonio.villalba.garcia@xunta.gal)
- [4] Université de Bordeaux (Contact: xavier.de-montaudouin@u-bordeaux.fr)
- [5] Université de Cork (Contact: s.culloty@ucc.ie)
- [6] Université de Bangor (Contact: s.malham@bangor.ac.uk)
- [10] IPMA (Contact: fruano@ipma.pt)
- [11] Université d'Aveiro (Contact: rosafreitas@ua.pt)
- [15] Ifremer La Tremblade (Contact: isabelle.arzul@ifremer.fr)
- [17] CNRS Arcachon (Contact: patrice.gonzalez@u-bordeaux.fr)
- [20] INTECMAR (Contact: sdarriba@intecmar.gal)

Collaborateurs hors projet :

- [A] NIOZ- Texel (Contact: david.thieltges@nioz.nl)
- [B] ICMAN-CSIC (Contact: jose.cuesta@icman.csic.es)
- [C] Wageningen Bioveterinary Research (Contact: marc.engelsma@wur.nl)
- [D] USC (Contact: seiladiazcostas@gmail.com)
- [E] Arrhus University (Contact: kthomas@bios.au.dk)



Techniques de diagnostic

- **Histologie:** Les microcolonies bactériennes basophiles, dont la forme et la taille varient, sont observées dans les cellules épithéliales du diverticule digestif ou dans les branchies. De grandes colonies extracellulaires entourées d'une couche fibreuse peuvent être observées dans les branchies et plus rarement dans le tissu conjonctif du manteau et des palpes labiaux.
- **Laboratoires spécialisés/Contacts dans le consortium COCKLES AA:** [2], [5], [10], [15], [20], [D].

Risques dans l'Espace Atlantique (AA)

- **Situation actuelle:** Inconnue.
- **Concernant le commerce:** Inconnu, mais absence de risque pour la consommation humaine.
- **Changement global :** Inconnu.

Recommandations

Les coques provenant de zones infestées ne doivent pas être déplacées vers des zones où aucune microcolonie bactérienne n'a été détectée. Aucune action dans les réserves naturelles.

Références pertinentes

Azevedo 1993; Carballal et al. 2001; Elliot et al. 2012; Longshaw & Malham 2013; Cano et al. 2020.



- Genes Accession number: MT019830 (COI), MN876028 (ITS1),



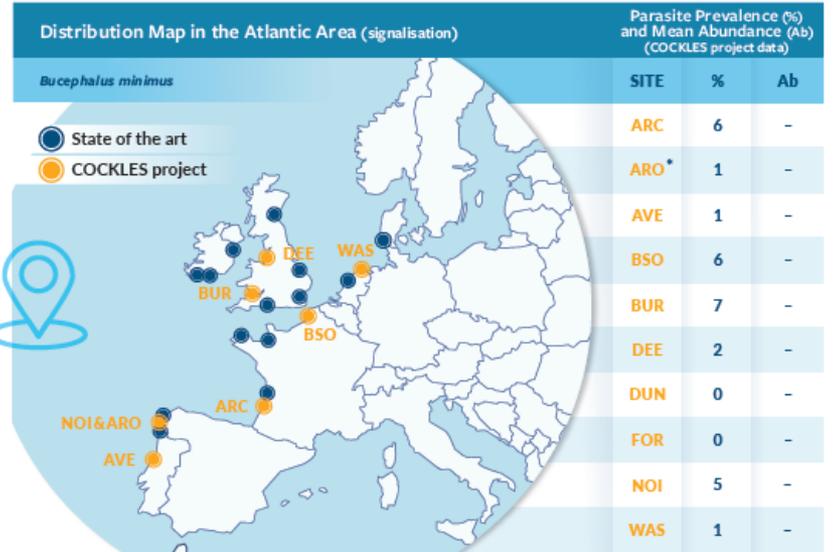
- Números de acesso de genes: MT019830 (COI), MN876028 (ITS1), MN879354 (18S).



- Número de acceso de secuencias xénicas no GenBank: MT019830 (COI), MN876028



- Numéro de code d'accésion GenBank : MT019830 (COI), MN876028 (ITS1)



*Detected by histology.

Diagnosis Techniques

- Histology: Possible to detect sporocysts but difficult species identification.

Genes Accession number: MT019830 (COI), MN876028 (ITS1), MN879354 (18S).

Risks in the Atlantic Area (AA)

- Actual situation: High prevalence outbreak is possible and has already been observed.
- Related to Trading: No risk within AA, at least between 21°N (Morocco) and 54°N (Scotland/Germany).
- Global change: Change of temperature can modify host dispersion and infection success. But life cycle is still unknown.

Advices

No action in nature conservation areas.

Relevant References

Desclaux et al. 2002; de Montaudouin et al. 2009; Pina et al. 2009; Feis et al. 2015; Magalhães et al. 2015, 2017.



REFERENCES

1. *Rickettsia*-like & *Mycoplasma*-like

Azevedo C. et al. 1993. Occurrence of an unusual branchial mycoplasma-like infection in cockle *Cerastoderma edule* (Mollusca, Bivalvia). *Diseases of Aquatic Organisms* **16**:55-59.

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BIBLIOGRAFIA

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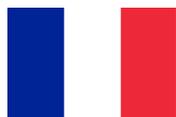


REFERENCIAS

1. Organismos de tipo *Endozoicomonas*

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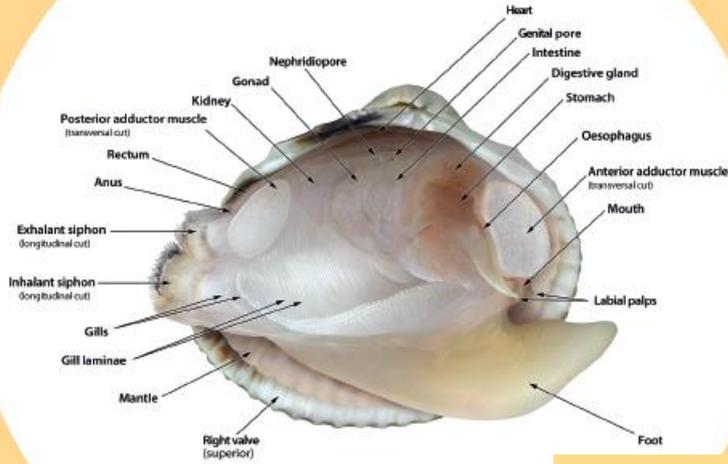
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Cockle Anatomy



Anatomia do berbigão



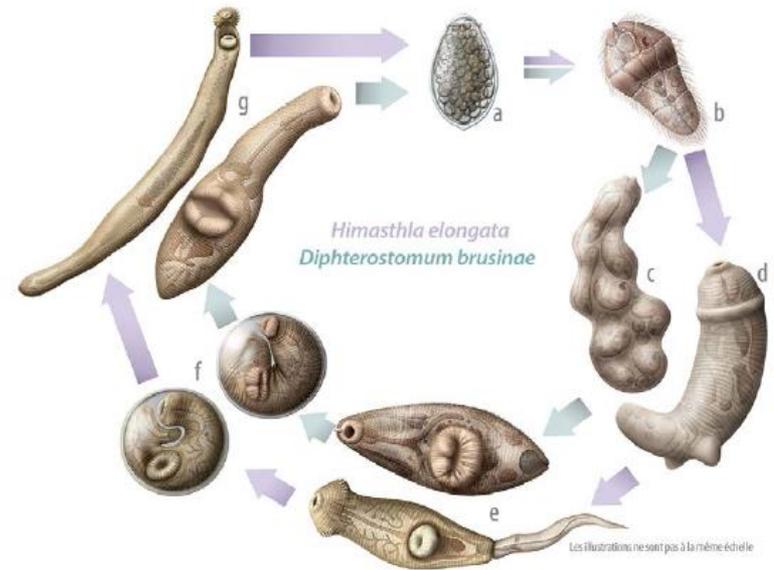
5 mm
Fernando Correia_2020

Anatomía do berberecho

Anatomie de la coque



TREMATODA





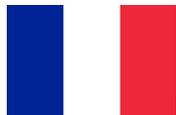
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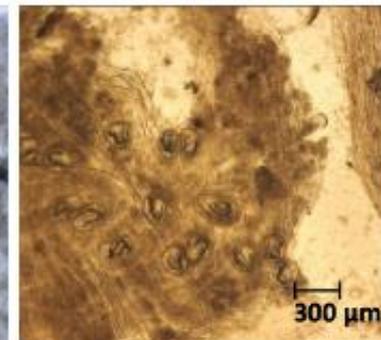
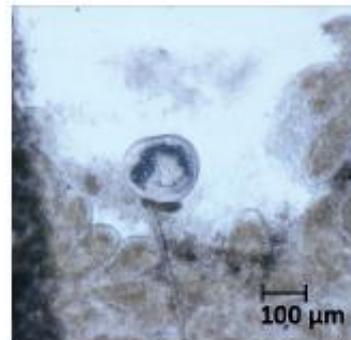
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- *Urosporidium* sp. (p. 42)
- *Marteilia cochillia* (p. 44)





GLOSSARY

Abundance – The number of parasite individuals in a host. “Mean abundance” is the mean number of parasites per host in the host population.



GLOSARIO

Abundancia Número de parasitos individuais presentes nun hóspede. A abundancia media é a media de parasitos por cada hóspede nunha poboación de hóspedes.



GLOSÁRIO

Abundância – O número de indivíduos parasitas num hospedeiro. “Abundância média” é o número médio de parasitas por hospedeiro na população de hospedeiros.



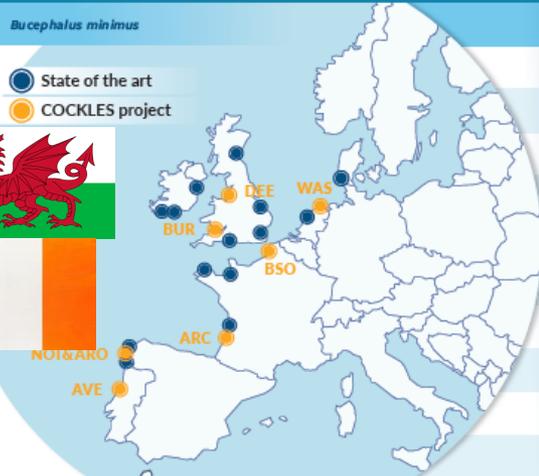
GLOSSAIRE

Abondance - Nombre d'individus parasites par hôte. «Abondance moyenne» est la moyenne du nombre de parasites par hôte dans la population d'hôtes.



Distribution Map in the Atlantic Area (signalisation)

Parasite Prevalence (%) and Mean Abundance (Ab) (COCKLES project data)

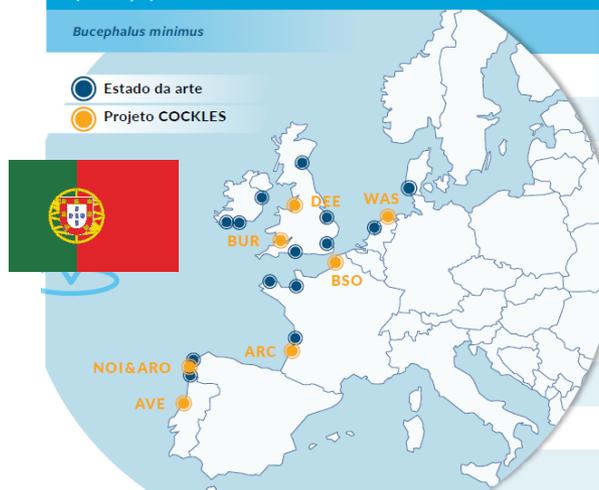


SITE	%	Ab
ARC	6	-
ARO*	1	-
AVE	1	-
BSO	6	-
BUR	7	-
DEE	2	-
DUN	0	-
FOR	0	-
NOI	5	-
WAS	1	-

*Detected by histology.

Mapa de distribuição na Área Atlântica (sinalização)

Prevalência de parasitas (%) e abundância média (Ab) (dados do Projeto COCKLES)

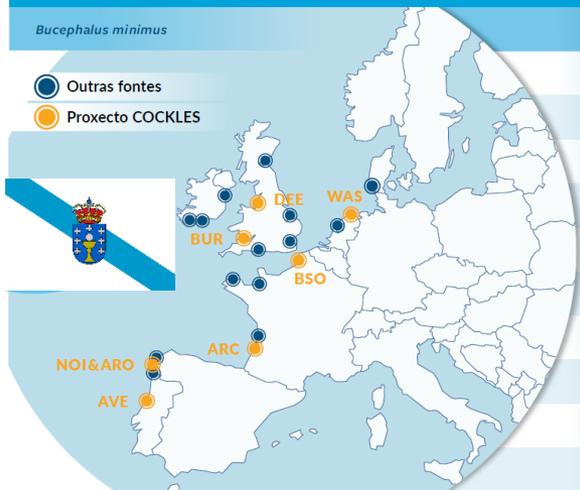


ÁREAS	%	Ab
ARC	6	-
ARO*	1	-
AVE	1	-
BSO	6	-
BUR	7	-
DEE	2	-
DUN	0	-
FOR	0	-
NOI	5	-
WAS	1	-

*Deteção através de histologia

Mapa de distribución na Área Atlántica (sinalización)

Prevalencia do parasito (%) e Abundancia media (Ab) (datos do proxecto COCKLES)

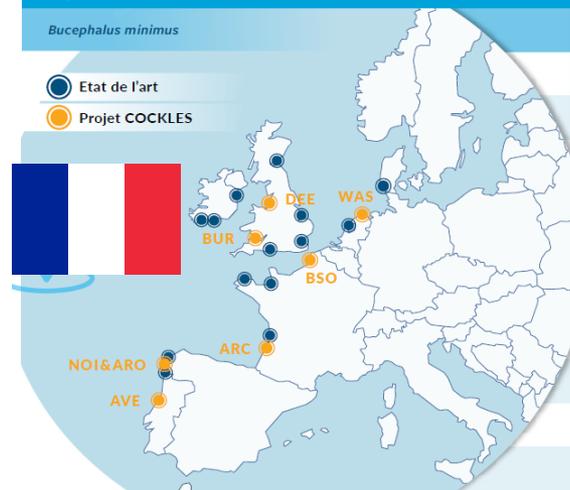


ÁREAS	%	Ab
ARC	6	-
ARO*	1	-
AVE	1	-
BSO	6	-
BUR	7	-
DEE	2	-
DUN	0	-
FOR	0	-
NOI	5	-
WAS	1	-

*Detectado mediante histoloxía

Carte de distribution dans l'Espace Atlantique (signalisation)

Prévalence parasitaire (%) et abondance moyenne (Ab) (données du projet COCKLES)



SITE	%	Ab
ARC	6	-
ARO*	1	-
AVE	1	-
BSO	6	-
BUR	7	-
DEE	2	-
DUN	0	-
FOR	0	-
NOI	5	-
WAS	1	-

*Détecté par histologie



Individual Pathogenicity



Sporocyst invades the whole body with negative effect on cockle fecundity, growth, condition and survival. Severe castration has been reported.

Populational Pathogenicity



Prevalence is generally low (< 1%) but episodic high infection breakdown have been reported with high mortality.



Patogenicidade individual

Patogenicidade populacional



Patoxenicidade individual

Patoxenicidade poboacional



Pathogénicité individuelle

Pathogénicité populationnelle

Risks in the Atlantic Area (AA)

- **Actual situation:** Low risk. At high intensity, it participates to natural mortality.
- **Related to Trading:** Risk within AA, because it has been detected only in few sites, with the highest intensities South to Arcachon Bay.
- **Global change:** Change of temperature can modify host dispersion and infection success. But life cycle is still unknown.

Risco na Área Atlântica (AA)

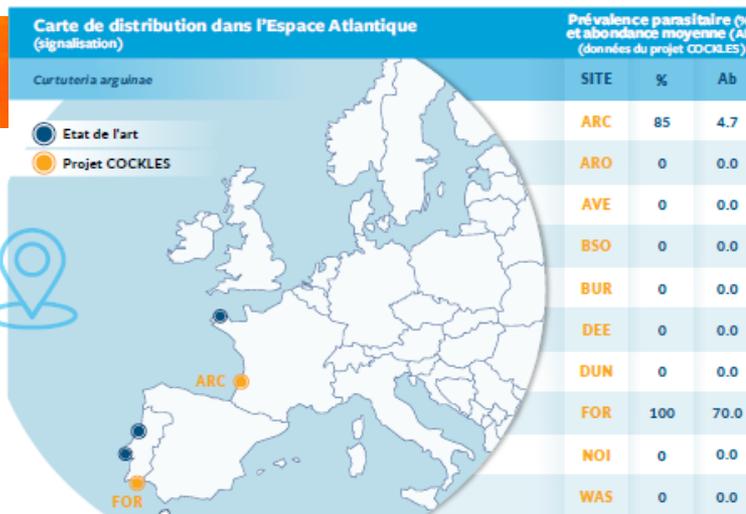
- **Situação atual:** Risco baixo. A uma intensidade elevada, participa na mortalidade natural.
- **Em relação ao comércio:** Risco na AA, uma vez que foi detetado apenas em poucos sítios, com as intensidades mais elevadas a sul da Baía de Arcachon.
- **Alterações globais:** As alterações de temperatura podem modificar a dispersão do hospedeiro e o sucesso da infeção. Mas o ciclo de vida ainda é desconhecido.

Riscos no Espazo Atlántico (AA)

- **Situación actual:** Risco baixo. Con alta intensidade, contribúe á mortalidade natural.
- **Relativos á comercialización:** Risco dentro do Espazo Atlántico dado que só se ten detectado en poucas localizacións; as intensidades maiores déronse desde a baía de Arcachon cara ao sur.
- **Cambio global:** Os cambios nas temperaturas poden modificar a dispersión dos hóspedes e o éxito da infestación. Con todo, aínda se descoñece o seu ciclo biolóxico.

Risques dans l'Espace Atlantique (AA)

- **Situation actuelle:** Risque faible. Contribue à la mortalité naturelle en cas de forte intensité.
- **Concernant le commerce:** Risque dans l'Espace Atlantique, en raison d'une détection dans quelques sites seulement, avec l'intensité la plus élevée dans le Bassin d'Arcachon.
- **Changement global:** Le changement des températures peut modifier la distribution des hôtes et la progression de l'infestation. Mais le cycle de vie reste inconnu.



Techniques de diagnostic

- **Histologie:** Il est possible de détecter les métacercaires enkystées, mais l'identification de l'espèce est difficile.
- **Dissection:** Écrasement entre deux lames de verre épaisses, sous stéréomicroscope. L'extraction de métacercaires est obligatoire pour faire la différence, sous microscope, avec *H. quissetensis* (33 épines orales contre 31 dans *H. quissetensis*).
- **Numéro de code d'accèsion GenBank:** MT002920 (COI), MN876025 (ITS1), MN879358 (18S).
- **Laboratoires spécialisés/Contacts dans le consortium COCKLES AA:** [4], [11], [17]

Risques dans l'Espace Atlantique (AA)

- **Situation actuelle:** Risque faible. Contribue à la mortalité naturelle en cas de forte intensité.
- **Concernant le commerce:** Risque dans l'Espace Atlantique, en raison d'une détection dans quelques sites seulement, avec l'intensité la plus élevée dans le Bassin d'Arcachon.
- **Changement global:** Le changement des températures peut modifier la distribution des hôtes et la progression de l'infestation. Mais le cycle de vie reste inconnu.

Recommandations

Aucune action dans les réserves naturelles.

Références pertinentes

Descieux et al. 2006; de Montaudouin et al. 2009.



Advices

Eradicate moribund cockles at the surface of the sediment in production areas. No action in nature conservation areas.



Recomendações

Erradicar berbigões moribundos à superfície do sedimento nas áreas de produção. Nenhuma ação em áreas de conservação da natureza.

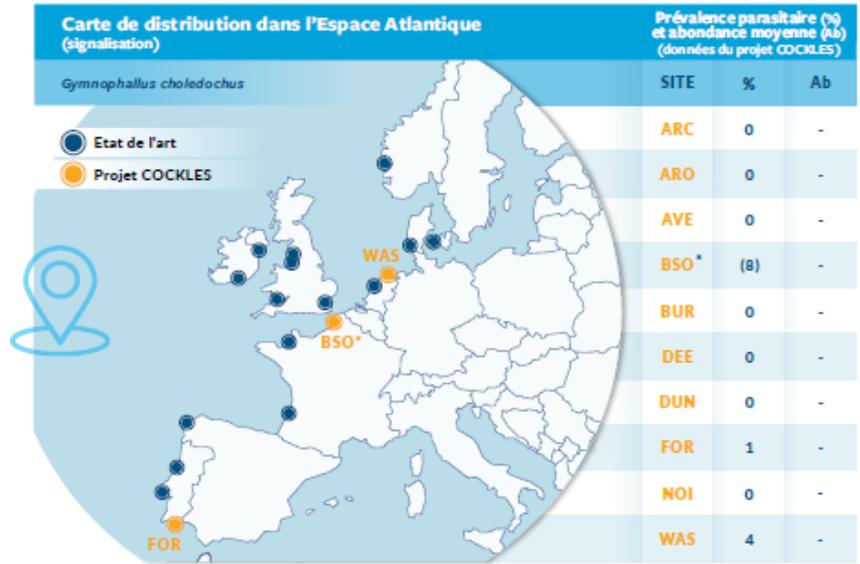
Recomendacións

Retirar os berberechos moribundos da superficie dos bancos marisqueiros. Non actuar en áreas naturais protexidas.



Recommandations

Éliminer les coques mortes sur la surface du sédiment dans les zones de production. Aucune action dans les réserves naturelles.



Techniques de diagnostic

- **Histologie:** Il est possible de détecter des sporocystes, mais l'identification de l'espèce est difficile.
- **Dissection:** Écrasement: entre deux lames de verre épaisses, sous stéréomicroscope.
- **Numéro de code d'accèsion GenBank:** MN547969 (COI), MN592818 (ITS1), MN544854 (18S).
- **Signature moléculaire différente dans la Baie de Somme (BSO).**
- **Laboratoires spécialisés/Contacts dans le consortium COCKLES AA:** [4], [11], [17], [A], [E].

Risques dans l'Espace Atlantique (AA)

- **Situation actuelle:** Une forte augmentation de la prévalence est possible
- **Contexte géographique:** L'Espace Atlantique, du moins entre le 28° parallèle nord (Maroc) et le 60° parallèle nord (Norvège).
- **Changement global:** Le changement de température peut modifier la distribution des hôtes et la progression de l'infestation.

Recommandations

Éliminer les coques mortes sur la surface du sédiment dans les zones de production. Aucune action dans les réserves naturelles.

Références pertinentes

James & Bowers 1967; Loos-Frank 1975; Thielges 2006; Thielges et al. 2006; de Montaudouin et al. 2009; Rangel & Santos 2009; Magalhães et al. 2020.

CONCLUSION – RISKS IN THE ATLANTIC AREA SITES

Pooling COCKLES project data from 33 sites, 100 species of parasites/diseases have been identified from low to high risk (right side), according to the number of sites/diseases (left side). Red numbers correspond to confirmed deleterious parasites/diseases reported in each site. Red numbers correspond to confirmed deleterious parasites/diseases reported in each site.



Hyperparasites not included

Thanks

This book will be available in free access in the COCKLES website

<http://www.cockles-project.eu/>

And there is a functional link with the SIG viewer which will be presented by Elena Couñago Sánchez (CETMAR)