



KIT
GUIDE



Education Kit Guide

COCKLES Project

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Preface

Welcome to the Official Educational Kit of the COCKLES Project (Co-Operation for Restoring Cockle Shellfisheries and its Ecosystem Services in the Atlantic Area). This Kit use texts, illustrations and practical methods to help teachers and students to understand the importance of restoring and increasing cockle populations and the wealth of services they provide to coastal communities in the Atlantic Area. It will show you how, by our attitudes and behaviours, as well as by our consumption patterns, we can all play a part in protecting cockle populations and local fishing businesses. Besides this guide, within the Kit, teachers will find folders with information on different activities, the materials needed for each activity and the target age group (6+, 10+ or All).

The COCKLES team hopes that teachers will find the Kit to be a useful and interesting resource to deepen students' knowledge of biodiversity. There is a special focus on cockles and we hope that this will help to develop an understanding of this important biological resource and a recognition that its conservation is crucial for ecosystem health.

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The COCKLES Project

Cockles provide a wealth of services to coastal communities in the Atlantic Area but they have been suffering from periodic mass mortalities which have severe effects on natural stocks. The frequency and intensity of such events have significantly increased in the last 50 years, especially for the most valued native species, *Cerastoderma edule*. The abundance of this species has dramatically decreased in the last decade due to the devastating effects of emergent diseases. Overfishing, inefficient management and deteriorating environmental conditions have also led to a severe decline in production throughout the Atlantic Area. Cockles are considered a delicacy of the cuisine in the Atlantic region and an asset for tourism. From a social perspective, cockles are traditionally exploited by small associations often with high levels of female employment. In terms of environment and biodiversity protection, the cockle is a keystone species, i.e. a species that plays a crucial role in maintaining the structure of an ecological community or ecosystem. The decline in production threatens the equilibrium of local food-webs in coastal environments.

Mass mortalities and declining stocks have already resulted in economic and ecological losses. This has severe consequences for the social structure of coastal communities, and for the wider ecosystem services and societal benefits provided by cockles. The main goal of the COCKLES Project (Co-Operation for Restoring Cockle Shellfisheries and its Ecosystem Services in the Atlantic Area) is to restore and increase cockle production and the services provided by this emblematic resource. To do this it focusses on improving aquaculture practices, developing resistant strains and recovering natural stocks. It also works with communities and organisations to optimize management and upskill stakeholders so that they can aid the recovery of local natural resources, increase the understanding of ecosystem services and obtain or protect good ecological status and boost coastal economies of the Atlantic Area.



READING TIME

Start to read “A cockle story” to your class. They will meet the adventures of Mick, a small lucky cockle.

The European edible cockle

General description

The European edible cockle *Cerastoderma edule* is a marine bivalve mollusc of the family Cardiidae. The scientific name is derived from the Latin adjective “edulis” that means edible. Molluscs represent the largest phylum within the marine invertebrate animals. They have a high morphological diversity and can inhabit a great variety of systems, from marine environments, to freshwater and terrestrial habitats. They are soft-bodied, unsegmented animals, with a body organized into a muscular foot, a head, a visceral mass containing most of the organs and systems, and a fleshy mantle that secretes the calcareous shell. Examples of molluscs include familiar organisms such as snails (Class Gastropoda), squids (Class Cephalopoda) and oysters (Class Bivalvia). The cockle is a member of Bivalvia (also called as bivalves), a group of organisms that can display different shapes and colours but are generally characterized by a shell that is divided into two valves connected at a hinge (Figure 1). Most bivalves are marine animals, but some species can also be found in freshwater environments.

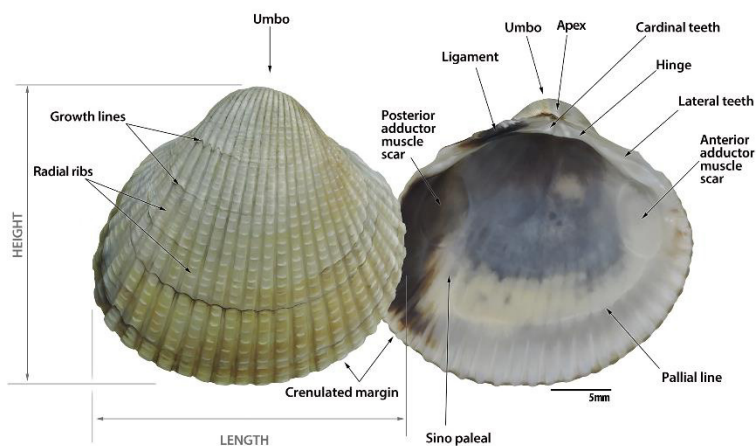


Figure 1 External and internal features of a cockle shell.



ACTIVITY 1

LEARNING THE VOCABULARY RELATED TO COCKLES

In this activity you and your class will get used to some vocabulary related to cockles. Find and circle all of the words that are hidden in the grid. This activity requires the use of the Soup Word Search provided (Folder A). When the activity has been completed, the solution can be consulted on the “post-activity” information.



ACTIVITY 2

SHELL CLASSIFICATION USING A DICHOTOMOUS KEY

In this activity you and your class will use the same technique as scientists to classify organisms through shells; a dichotomous key. A dichotomous key is a tool that allows the user to determine the identity of items in the natural world. The key consists of a series of choices, with always two options in each step, that lead the user to the correct name of a given item. This activity requires the use of the shells kit provided (Folder B). When the activity has been completed, the identities of the species can be consulted on the “post-activity” information. For the youngest, a simpler version of the activity is provided.

Life cycle and adult anatomy

Like most bivalves, cockles present no external morphological differences between the sexes, each individual display only one sex, i.e. ones are male and other are female. Cockles reproduce sexually. Sexual maturity is usually reached when cockle shell length reaches 12-14 mm, although this may be strongly driven by seasonality and other external environmental variables. Cockle reproduction and development includes a gametogenesis process occurring in spring (February–March) followed by a rapid gonad development (April–May). Spawning can occur from May to July/August. Gametes (eggs and sperm) are produced in the gonads. When mature, gametes are shed into the mantle cavity and they reach the open sea through the exhalant syphon, thanks to water currents created by gills and body contractions. Fertilization takes place in the water column and eggs will develop through a series of larval stages. First, a ciliated larvae stage called trochophore and then a veliger larvae which possess a velum used for swimming and feeding. After 10-15 days of planktonic life, the larvae develop a foot (they are now called pediveliger) and go down to the bottom to start the settlement. The pediveliger will use byssus to fix itself and with the help of the foot it can

make small movements to find the best place to settle. At this moment will occur the metamorphosis involving major morphological changes, becoming into a free juvenile not attached by the byssus any more. All the cockles that settle with success at the same time are defined as a cohort, so a cohort is a group of organisms within a common age group. A cohort lifespan can reach up to 40 months, the individuals of the cohort can reach 5 cm in length and span a geographically variable range. The full life cycle of a cockle is represented in Figure 2.



Figure 2 General representation of a cockle life-cycle.

Anatomically (Figure 3), a cockle is formed by a dorsal visceral mass and a ventral foot, covered by a thin mantle. The mantle forms the pallial cavity which contains the gills and the labial palps. Cockles possess two siphons (one inhalant and the other exhalant in the upper and lower position, respectively), through which respiratory and metabolic exchanges occur. The cockle's muscular system is composed of adductor muscles, one posterior and one anterior. These muscles connect the two valves and contract to close the shell. They act in the opposite direction to the ligament that open the valves. Like all bivalves, cockles have an open circulatory system, which means that the haemolymph (blood) does not circulate within vessels (such as veins or arteries in humans). The heart of a bivalve is composed by three chambers: two auricles that receive the oxygenated haemolymph from the gills and a ventricle that pumps the haemolymph to the remaining organs.

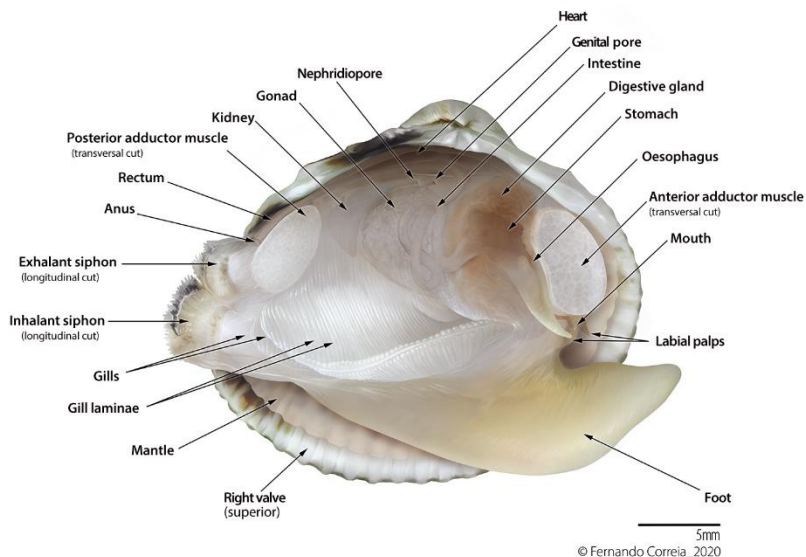


Figure 3 *The internal, soft tissue anatomy of a cockle.*



ACTIVITY 3

MICROSCOPIC EXAMINATION OF TISSUES

In this activity you and your class will use microscopic observation to recognize the different organs of cockles. This activity requires the use of the histology slides provided (Folder C) and the consultation of the histology mini-guide “What the shell is histology?”. Histology is the study of tissues and their microscopic structures. For the youngest, and those that have no microscope in your class, two other versions of the activity are provided.

Habit, habitat and distribution

Cockles are generalist, opportunistic filter feeders. Through the inhaling siphon, cockles inhale large amounts of water containing suspended food particles such as phytoplankton, microorganisms or organic matter. These particles are trapped in the gills and transported to the mouth before passing through the digestive tract. Thus, the gills have a gas exchange function but are also used for food capture. Finally, the metabolic waste is expelled from the body into the water through the exhaling siphon.

While other bivalves are able to colonize hard substrates using anchoring byssus (e.g. mussels) or cementation (e.g. oysters), cockles live within soft sediments.

The division and lateral compression of the shell into two valves is clearly related to the adoption of a burrowing mode of life. Cockles use their foot to move and to bury into the sediment, an activity that can significantly influence the biological processes occurring in the surrounding substrate. For this reason, i.e. for their bioturbation activity, cockles are often called as ecosystem engineers.

Cockles live in soft sediment habitats found in semi-sheltered marine systems along the north-eastern coast of the Atlantic Ocean, from northern Europe (Norway, Russia) to the coasts of West Africa (Senegal) (Figure 4).



Figure 4 Geographic distribution of *Cerastoderma edule*.



ACTIVITY 4

IDENTIFICATION OF BIVALVES HABITAT

In this activity you and your class will identify the habitat of different bivalve species: cockles, mussels, oysters, clams and razor clams. A habitat is the type of natural environment in which a particular organism lives. This activity requires a prior consultation of the “background information”, the use of the ecosystem layout and bivalve stickers provided (Folder D). When the activity has been completed, the correct assignment can be consulted on the “post-activity” information.

Ecology and ecosystem services

Representing a major proportion of the benthic fauna biomass in marine ecosystems, cockles have an important ecological role. Among other functions, cockles impact nutrient cycling, create and modify habitats. Besides this, on one hand they are part of food webs directly (as food for many birds, fish, crustacean or echinoderm species) and on the other hand indirectly by generating a flow of nutrients and matter when they are eaten by secondary consumers. Furthermore, compounds that accumulate in their soft tissue and shells can be used as environmental monitors. For all these reasons, cockle populations have been shown to provide a suite of important ecosystems services including water quality improvement, coastal protection and habitat formation, in addition to providing a direct food resource.



ACTIVITY 5

ECOSYSTEM SERVICES PROVIDED BY COCKLES

In this activity you and your class will learn more about the ecosystem services provided by cockles. Ecosystem services are the benefits people obtain from ecosystems. These include provisioning services such as food and water; regulating services that affect by instance climate and water quality; cultural services that provide recreational, aesthetic, and spiritual benefits; and supporting services such as habitat formation. This activity requires the use of the colouring pages and the coloured pencils provided (Folder E). For the older, an advanced version of the activity is provided.



ACTIVITY 6

TEST YOUR KNOWLEDGE

In this activity you and your class will test the knowledge acquired throughout the exploration of this kit. Remember that you can always broaden your knowledge by your own or with your teacher's support. This activity requires the use of the Card game provided (Folder F). When the activity has been completed, the solution can be consulted on the "post-activity" information. For the youngest, a funny match game is provided.



ACTIVITY 7

CREATE YOUR BOOK MARK

In this activity you and your class can create a book mark that can be used to mark your favourite activities in this guide or to slip between the pages of your favourite book. This activity requires the previous collection of empty shells in your local beach and the use of the material provided (Folder G). In alternative, students can use the shells provided to create any piece of art.



Co-Operation for Restoring
Cockle SheLfisheries
and its Ecosystem Services
in the Atlantic Area (AA)



Interreg
Atlantic Area
European Regional Development Fund



EUROPEAN UNION