Cousteau Divers Mediterranean Dive Log

Cousteau Divers is worldwide community of divers united to become active agents of the study and preservation of marine life, inspired by Jacques Cousteau and his amazing life achievements. When Cousteau invented scuba diving as we know it today in 1943, he opened the eyes of millions of people to the beauty, and fragility, of the underwater world. With great knowledge comes great responsibility. Today, divers are the only people in the world who witness the state of the oceans on a daily basis. We are uniting to form the front lines of a global movement to help protect them.

Jacques-Yves Cousteau began his exploration of the undersea universe in the Mediterranean Sea, in 1943 when he co-invented the regulator. Shooting his first underwater images off the coast of Marseilles, he spent his life discovering the amazing treasures beneath the surface of the world's oceans. Cousteau shared all of these wonderful experiences with the general public by producing documentaries broadcast on television. In the Mediterranean alone, he made seven films, one of which ("Mediterranean: cradle or coffin?"), an ecological assessment of the situation of this closed, and over-exploited sea.

"Once more, I drift downward through the blue spaces of the sea. Out of the depth, there rises towards me a garden of sea fans, the sculptured branches of gorgonians. Since ancient times, troubled men have sought renewal in desert and wilderness. Today, in these solitudes of the sea, man must create sanctuaries against himself. Once, they called the Mediterranean "mare nostro", our sea. Around it, men built the temples and marketplaces of our past, shaped the inner world of our beliefs. Here, painfully, century-by-century, warring nations began to learn that our sea lay in the common custody of all. Today, we are beginning to learn that our sea means even more, that we protect life, not out of arrogant charity or sentimental compassion. In full truth, we are partners to the fish, the crab, the snail, the grasses that grow in secret places beyond our sight. Upon their lives, our lives depend. Upon their survival, hangs our own." Jacques-Yves Cousteau, 1980.

The Cousteau Divers program is structured around three major axes: Science, Community and Multimedia. Dive into our program on www.cousteaudivers.org, and share your geo-tagged underwater images with the rest of the world, allowing us all to witness the state of our oceans and to compare them with Cousteau archive images.

Cousteau Divers is establishing diver observation programs in different regions around the world, and you will find dive log methods for the Caribbean, Mediterranean, Red Sea and South-East Asia regions as well.

The following manual will help you understand and complete the Cousteau Dive Log. Your observations could provide valuable information on the status of our coastal seas. The Cousteau Diver program aims to capture this information in a simple and entertaining way, and provide the vehicle through which recreational divers can contribute towards monitoring the health and wealth of the marine life in our oceans.

Cousteau Divers train themselves to record their observations after their dives on the Dive Log and upload them later on the website www.cousteaudivers.org. The Cousteau Divers training is also offered through accredited Cousteau Dive Centers all over the world. The accreditation program for dive centers involves the provision of specialist training for the dive centers to enable them to run the Cousteau Divers training course, as well as the use of training tools to help students progress in reporting their observations. Cousteau Dive Centers and divemasters serve as permanent observers of their dive sites. They monitor the evolution of additional parameters, such as salinity, pH and oxygen concentrations. Cousteau Dive centers are also encouraged and assisted in having their dive sites declared no-take zones, catering for the natural ecosystem to develop and enrich over the years.

Guide to the Cousteau Divers Log

The Cousteau Divers - Dive Log

The Cousteau Divers - Dive Log allows you to record your personal observations underwater during your dive. Dive operators can also use the Dive Log to record the observations of dive clients by working as team on your dive sites. The observations recorded on the Dive Log can then be entered into the online form on the Cousteau Divers website the next time you have access to the internet.

How do I complete the Cousteau Divers - Dive Log?

The Cousteau Divers - Dive Log is divided into three main sections in which to capture information about the dive, the site and focal species / groups. The guidance notes below explain how to complete each section of the Dive Log. All information is meant to be collected as soon as possible after the dive.

As you will see, you can collect the observations of other people who came on the same dive, gathering as much information as possible on the dive site.

What will happen to the information collected by Cousteau Divers?

The Dive Log data entered into the website is automatically analyzed and a simplified version displayed on the website. The data collected by Cousteau Divers is also made accessible to scientists, local managers of Marine Protected Areas, local authorities and non-governmental organizations (NGOs) working in the region to help with their research and environmental monitoring. Scientists are able to request datasets through an online request form. This allows Cousteau Divers to track where the data is going, who is using the data, and how it is being used. Scientists interested in this data have the opportunity to create a specific profile on the website, and will be kept informed in real-time as the data come in.

About the Dive

On this section of the Cousteau Divers - Dive Log you will record the basic information about the dive (country, geographic location, dive rating, maximum depth, and depth of observation).

- **Photographs**: Tick if you took photographs during the dive / snorkel (see notes below) and will be uploading them on www.cousteaudivers.org

- **Video**: Tick if you recorded video during the dive / snorkel (see notes below) and will be uploading them on www.cousteaudivers.org

How do I prepare images for uploading onto the Cousteau Diver Website?

A photograph (or video) can speak a thousand words! The types of photographs or videos that would be most interesting for scientists would include general shots (e.g. using a standard or wide-angle lens) that capture the characteristics of the site or close-up shots (e.g. using a macro or a standard lens with macro setting on your camera) that capture representative, unique or unusual species. If you spot something that causes you concern you can also submit images of impacts at the site.

When preparing to upload your images (photographs or videos) onto the Cousteau Diver website try be selective. You only need to upload the images that best illustrate the characteristics of the site (e.g. landscapes, habitats) or species of interest (e.g. fish and other marine life). Tag the photographs as accurately as possible, including country, date, location and species identified as you upload them onto the Cousteau Diver website.

- **Dive Site**: Record the name of the dive site or the nearest location if there is no given dive site name.

- **Latitude / Longitude**: It is very important that you locate your observations with as much accuracy as possible. Ideally, record the GPS coordinates yourself or ask your dive center. Record the Latitude / Longitude using the WGS-84 (World Geodectic System-84) in degrees and decimal minutes. For example, the coordinates 37.6732°N and 2.3567°E are in decimal degrees. The coordinates for the same location in degrees and decimal minutes would be 37°40.3920'N and 2°21.4020'E.

If you can't get the exact coordinates for the dive site, ask your dive master to point out the site location on a map AND note the name of the dive site.

- **No. of Divers**: Record the number of divers on the dive that contributed observations to the Dive Log. Don't be shy! And don't hesitate to ask your fellow divers what they saw during the dive.

- **Dive Site Rating**:

  - *Landscape*: Rate the underwater landscapes at the site using a scale of 1 to 5, where 1 is a site with an unremarkable landscape and 5 is a site with amazing scenery. If completing the survey with clients ask them to provide you with the rating.

  - *Marine life*: Rate the marine life at the site using a scale of 1 to 5, where 1 is a site with poor marine life and 5 is a site with an abundance of marine life. If completing the survey with clients ask them to provide you with the rating.

About the Site

On this section of the Cousteau Divers -Dive Log you will record information on the characteristics of the dive site and the conditions at the site.

- **Site Conditions**: On this sub-section of the Cousteau Divers - Dive Log you will record information about the conditions at the dive site on the day of the dive. This information provides an indication about the type of site. The conditions on the day of the dive can also affect the ability of the Cousteau Diver to record information and may help to explain unusual observations. You can record this information at the start or the end of the dive.

Circle the symbol that best represents the conditions on the day of your dive.

- **Seabed Composition**: On this sub-section of the Cousteau Divers -Dive Log you record information about the physical structure of the seabed in terms of different components: coral reef, solid rock / bedrock, boulders, cobbles, gravel, sand and mud.

During your dive, observe the substrate. Some habitats may be entirely covered by biological organisms so you need to be careful and try to determine what substrate these organisms are growing on (you will record the biological cover on the next part of the form). Try to identify which is the dominant type (i.e. is >50 % of the seabed composed of one type, such as sand or rock). If the main focus of the dive is a wreck then you can indicate the wreck as dominant.

The structure and composition of the seabed provides an indication of both the complexity of the substrate and the stability of the site, both of which are important determinants of the type of marine life. Different types of substrate support different types of animal and plant communities. Substrates such as rock or large boulders provide a stable habitat, as they are rarely moved by wave action or currents, on which diverse communities can develop over a long period of time.

More mobile substrates like muds, sands, gravels and smaller rubble may be subject to more regular disturbances, and this can affect the type of organisms able to colonize the habitat and the

communities that develop over the long term. The structure and composition of the substrate together give an impression of the complexity of the substrate.

Tick the box if the given substrate is present and mark a cross if it is the dominant substrate.

Note: Boulders are >25cm in diameter, Cobbles are 6-25cm, Gravel is 0.2cm-5cm, Sand is smaller than 0.2cm in diameter. For the Mud type, no grains are visible.

- **Seabed Cover**: On this section of the Cousteau Divers - Dive Log you will capture information on the biological organisms living on the seabed (benthic organisms). You will record the presence of the different types of benthic organism found at the site, and indicate which of these provides the dominant cover (e.g. if >50 % of the seabed is covered in seagrass, then this is the dominant cover).

Tick the corresponding box if that substrate is present, and mark a cross if the substrate provides the dominant cover of the dive.

- **Algae**: There are three broad categories as described below.

Importance: Algae are primary producers and an important food and energy source for some groups of animals (such as fish and sea urchins). The 'microhabitats' created by turf and erect algae are also important to many small animals such as worms and crustaceans (crabs, shrimp).

Threats: Threats to these communities include physical impacts due to fishing and recreational divers, pollution, and invasive species. Coralline algae are particularly vulnerable because they grow slowly so it takes time for these communities to recover if they are damaged. Climate change poses another threat as warming sea temperatures and ocean acidification may impact calcification rates.

- *Turf algae*: Turf algae is also often known as filamentous algae, and it is typically not much more than 1 cm in length. Turf algae can form dense carpets that may be found growing on other habitats, such as crustacean or mollusk beds, or on algal beds. They can create microhabitats of importance for a wide variety of species, including fish and urchins and other groups that feed off these algae.

- *Frondose algae*: There is a huge variety of different forms of erect or frondose algae. These may include red, green and brown algae such as Sargassum and kelp.

- *Coralline algae*: Coralline algae is the common name for a number of different red algae species from the Corallinaceae family. These algae are usually more of a pinkish-red color and they characteristically have a hard skeleton made from calcium carbonate. Globally, there are many different species and some of these form calcium carbonate constructions, which provide a habitat for a host of other species including polychaetes, cnidarians, mollusks, sponges, bryozoans, foraminferans and crustaceans. Coralline algae are sensitive to water temperature, nutrients and other environmental conditions.

- **Benthic animals**: This section only refers to non-mobile animals that grow attached to the seabed.

There are numerous different types of benthic animals that might be encountered in different habitats, including sponges, tunicates, anemones, barnacles, mollusks and hard and soft corals (including gorgonians). There are a few of these groups that are bio-constructors and may form biogenic reefs, such as corals, polychaete worms, barnacles and mollusks, amongst others.

Importance: Different groups of benthic animals are important for different reasons. Some are important as food for other organisms while other groups that are capable of creating reef-like structures provide habitats for other organisms and increase diversity.

Threats: These types of organisms may be damaged by physical impacts due to fishing, or other disturbance, pollution and sedimentation from land-run and rivers, and other impacts (including recreational divers). Some groups may also be threatened by climate related threats due to warming sea temperatures and ocean acidification.

- *Hard corals*: Hard corals are animals that are related to sea anemones, with the important difference that they lay down a skeleton of calcium carbonate (limestone) to provide themselves with support. Most true reef building corals contain small single-celled algae (zooxanthellae) that live inside their tissues. These algae create energy from sunlight and this is transferred to the host coral. The algae also contribute towards the corals color. If the coral is exposed to high seawater temperatures or other stressors they may lose their algae. This process is known as 'coral bleaching' because the coral appears 'pale' or white as the calcium carbonate skeleton becomes visible through the animals tissue.

- *Soft corals, sea fans and black corals*: There are numerous different types of soft corals, which grow in a number of very distinctive forms, from branching and tree-like to encrusting, and are often brightly colored yellows, red, oranges and purples, and a wide range of colony shapes. Soft corals are also known as octocorals because they have eight tentacles around their mouths instead of the six found in true hard corals. Soft corals are related to hard corals, and there are a small number of species that do form a hard skeleton. However, most soft corals just have a network of hard calcium carbonate spicules that help to strengthen the body wall instead of a solid skeleton, resulting in a relatively flexible structure, but they are still easily damaged.

- *Sponges*: Sponges are primitive filter-feeding invertebrates that may be found on all types of seabed from the lower shore to great depths. They are composed of a body with a cavity but they lack any major organs. There are many different species of sponge but they are notoriously difficult to identify, not least because they can have different shapes depending the exposure of a site. In exposed locations these animals may form flat or rounded structures, whereas in more sheltered locations they may create larger structures and develop plant-like fronds.

- *Benthic animals (other):* Use this tick box to indicate the presence of other benthic animals that are not hard or soft corals, or sponges.

- *Bare*: Areas where there are no visible organisms growing on the seabed would be categorized as bare substrate. Areas of exposed mud, sand, gravel or pebbles may prevent the settlement and survival of organisms due the mobility of the substrate. While these bare areas of substrate may appear devoid of life they can often accommodate different types of organisms that can burrow into the sediment.

- **Human Impacts:** On this section of the Dive Log you will record the presence of human activities and impacts. The evidence of human impacts may include rubbish, fishing equipment, lost dive equipment or other visible impacts. Record the presence of the impact if one or two items are seen, or record the impact as abundant if more than two examples are seen at the site.

Focal Species – MEDITERRANEAN

On this section of the Cousteau Divers - Dive Log, you will record the species that you observe during the dive. There are four parts: fish, invertebrates, algae and other species. The species listed are characteristic of the region, and may include endemic species, exotic (non-native) species, flagship species, keystones, targets, vulnerable and bio-indicators of climate change or other impacts. The fifth section on this part of the form is for recording other observations from the surface.

Tick the box if present or mark a cross if abundant.

Fish

Grouper

Groupers are predatory fish that feed on other fish, and invertebrates such as crabs and octopus. There are approximately 14 species in the Mediterranean, which range in size as adults from less than 30cm to over 100cm. They are found in all habitats, but many species prefer rocky habitats. Young groupers may inhabit shallower depths, whereas older individuals may be found in deeper water, often near cliffs, caves and overhangs. Grouper are favoured food fish in many countries bordering the Mediterranean. The most popular and heavily exploited species are from the genera *Epinephelus* and *Mycteropera,* including the Dusky Grouper (*Epinephalus marginatus*), which is listed as 'Endangered' on the IUCN Red List.

Brown meagre (*Sciaena umbra*)

The brown meagre (*Sciaena umbra*) is a medium-sized fishes typically 30 to 40 cm long, with a maximum length of 60 cm. The body shape is distinctive, as it has a flat belly and a strongly arched back. The mouth is large and reaches the level of the eye. The body is grey with golden and silver glints. There are two fins on the back (dorsal fins) and the tail (caudal) fin is yellow with a black margin, and a straight-edge. The anal and pelvic fins are black with an anterior fin has a white border. This species feeds on small fishes and crustaceans. It is most active at night, but it can sometimes be encountered during the day among seagrass beds, at the entrance to estuaries, and on rocky bottoms close to caves or large crevices in which it can shelter found. This species is a popular food fish and is heavily exploited. It is considered to be 'Vulnerable' on the IUCN Red List.

Zebra seabream (*Diplodus cervinus cervinus*)

The zebra seabream (*Diplodus cervinus cervinus*) is one of three subspecies that is found in the Mediterranean and Atlantic. This fish has a big head and conic shaped snout, the body is silver or golden-coloured body with 5 wide, vertical chocolate-coloured stripes. The pectoral fins are large and the caudal fin has a pitchfork shape. It typically measures between 30 and 35 cm, with a maximum length of 50 cm. It is an omnivore and feeds on small invertebrates and seaweeds. It is typically found on rock shelves between 25 to 80 m depth, but may also occur down to 300 m on muddy bottoms. The species will forms schools of 4 or 5 individuals of different sizes. This species has not been evaluated by the IUCN Red List for conservation status.

Two-banded seabream (*Diplodus vulgaris*)

The two-banded seabream (*Diplodus vulgaris*) feeds on crustaceans, worms and molluscs. This is a medium sized fish, 20-25cm in length, with a maximum length of 45cm. The fish is mostly a silvery grey, with a broad black band in front of the back (dorsal) fin and an black ring around the base of the tail (caudal penduncle). This species is found in estuarine and marine waters on rocky habitats, but sometimes in sandy areas typically in waters < 50m but in depths up 160m. Young seabreams may shoal within seagrass beds. The species is a popular food fish and heavily exploited. There are 4 other species of *Diplodus* in the Mediterranean Sea, so care needs to be taken when recording these species.

Salema porgy (*Sarpa salpa*)

The Salema porgy (*Sarpa salpa*) is a species of bream, which feeds mainly crustaceans when young, while the adults are almost exclusively herbivorous. This species is often found over rocky habitats and sandy area with algal growth. It has golden stripes that run down the length of its body. The species is gregarious and may form sizeable schools. This species is not a favoured food fish, although it eaten. It can result in hallucinations when eaten, not due to the fish itself, but due to a compound found in the phytoplankton fed upon by the fish.

Dentex (*Dentex dentex*)

The Common dentex (*Dentex dentex*) is a large bream that can reach up 100 cm in length when adult. It has a large head, with the mouth on the lower side, and a small eye. The body is ovoid and the upper side is broader than the lower side. The body is silver coloured, with 5 broad indistinct dark bands. Large old individuals may be red all over. This species is a carnivore and feeds on fish, mollusks and cephalopods. It is typically found on rocky or rubble substrates, in shallow water less than 50 m deep and up to 200m. The adults are solitary while the young form schools. This is a popular food fish. This species is considered to 'Vulnerable' on the IUCN Red List.

Red Porgy (*Pagrus pagrus*)

The Red Porgy (*Pagrus pagrus*) is a species of bream, which can grow up to 85 cm long. The name comes from the characteristic reddish tint to the upper part of the body and fins. The underside is a silvery white, and there are also bluish spots along the back. The head is large with a distinctive rounded slope, quite large eyes, and prominent teeth, which allow it to feed on other fish, crustaceans and molluscs. The adults of this species are often found over hard rocky habitats, rubble or sand. Juveniles may be found on seagrass beds. This commercially important species has been heavily exploited and it is listed as "Endangered" on the IUCN Red List.

Gilthead seabream (*Sparus aurata*)

(also known as "Golden Bream", "Orata" or "Dourada" or "Dorado")

The gilthead seabream (*Sparus aurata*) has an oval shaped body, which is rather deep and compressed. The head profile is regularly curved and the eyes small, and the mouth low, with thick lips.

The fish is silvery grey, with a large black blotch at origin of the lateral line, and a reddish patch by the opercula. There is a golden band between eyes edged by two dark areas (not visible on young fish) and dark lines on sides of body. This species is mainly carnivorous and feeds on shellfish such as mussels and oysters. It is typically found in seagrass beds and on sandy substrates, from the shallow surf zone to about 30m depth, or up to 150m depth. The species is sedentary, and either solitary or found in small aggregations. The species is a very popular food fish and it is both fished and farmed commercially.

Rainbow wrasse (*Thallasoma pavo*)

The rainbow wrasse (*Thallasoma pavo)* can grow up to 20 cm and is found in the Mediterranean and neighbouring Atlantic. The usual colouration is blue, yellow, olive and green. Juveniles and females are yellow with thin vertical bands and five thicker blue bands, whereas males have just one blue band nearest the head. Juveniles have a dark blotch beneath the fin half way down their back. This colourful fish inhabits coastal waters near rocks and segrass beds. It is usually solitary, but may sometimes be observed in small groups. It feeds on small mollusks and crustaceans. Most other *Thalassoma* species are found in warmer tropical climates. The rainbow wrasse is however potentially an indicator of climate change, as the range has expanded northwards due to warming sea temperatures.

Dusky spinefoot (*Siganus luridus*)

The Dusky spinefoot (*Siganus luridus*) is a medium sized fish with a compressed body, the upper half of which is dark grey green, the underbelly is silver grey. This species is not native to the Mediterranean, being found more commonly in the Red Sea and Indian Ocean, it is known as lessepsian having entered via the Suez canal. It was first recorded in the Mediterranean in 1956. It has since established populations in several localities and succeeded to such an extent that it is now fished. It typically forms small schools in very shallow water or may be solitary. It prefers hard substrates of compacted sand with rock or coral debris, and feeds on a wide range of benthic algae. It is a food fish that is occasionally poisonous, and the spines on the back are venomous. This species is a potential indicator of climate change.

Grey Triggerfish (*Balister carolinensis*)

The Grey Triggerfish (*Balister carolinensis*) is native to the western Atlantic, found from Nova Scotia to Argentina. It is a relatively small fish, with an appearance that is typical of other triggerfishes, with a flattened body with angular outline, small eyes and deep-set dorsal and anal fins. It is usually found over hard substrate and feeds primarily on benthic invertebrates such as crustaceans, sea urchins, sand dollars, sea stars, sea cucumbers, and bivalves. It has tough rough skin but is an excellent food-fish, with firm white flesh, boneless fillets. This species is an indicator of climate change.

Scorpion fish (*Scorpaena porcusa*)

The scorpion fish (*Scorpaena porcus*) is a solitary and sedentary species found on rocky substrates. The species is a carnivore and feeds on fishes, crustaceans and molluscs. This fish is venomous, but the venom is heat instable and stings can be treated by running as hot water as one can tolerate on the affected area.

Barracuda (*Sphyraena sphyraena, S. chrysotaenia* and *S. flavicauda*)

There are several species of barracuda found in the Mediterranean. The most common species is the European barracuda (*Sphyraena sphyraena*) are voracious predators, feeding mainly on other fish and less frequently on cephalopods and crustaceans. It has an elongated body shape, pointed head, prominent sharp teeth, and they often grow to 60 cm but can reach lengths up to 165 cm. The species is pelagic, found in open coastal and offshore locations. *S. chrysotaenia* and *S. flavicauda* can also be found on the northern African coast.

Moray Eels (*Muraena helena*)

The Mediterranean moray eel (*Muraena helena*) is a nocturnal predator and feeds primarily on fish, but also on squid and crabs. It has an elongated body can reach lengths of up to 150 cm with a long fin that runs from the head to the tail. It is typically dark grey or brown with lighter coloured spots. Moral eels are found in rocky habitats and it is often found in crevices and holes.

Sharks

There are an estimated 47 species of shark found in the Mediterranean, including 20 top predatory species. Shark populations have collapsed in the last 20 years due to fishing pressure.

Rays

There are many different species of rays in the Mediterranean, such as big pelagic rays (Giant Devil Rays, *Mobular mobular*), stingrays (Dasyatidae), butterfly rays (Gymnuridae), eagle rays (Myliobatidae) and cownose rays (Rhinopteridae). Stingrays are mostly demersal and found in coastal waters to depths of 480m; there are 6 species in the region. Butterfly rays are also demersal and found in sandy areas, often near beaches, to 110 m depth; there is one species in the region. Eagle rays are coastal species, found to depths of 100 m; there are two species in the region. Cownose rays are semipelagic and found inshore and in deep water, in bays and lagoons and offshore banks; there is one species in the region.

Other Species

There is space on this part of the form record the scientific names of the other species of fish that you observe, if you are confident of their identification.

Invertebrates

Greater Slipper lobster (*Scyllarides latus*)

There are two commonly found species of slipper lobster in the Mediterranean (*Scyllarides latus* and *Scyllarus arctus*). These decapods crustaceans, typically have 10 pairs of legs, and characteristically

have shield-shaped structures either side of the head, which replace the primary antennae. These species may be found on the seabed on rock, stones and sand. *S. Latus* is most endangered and can be used as an indicator of fishing pressure.

Spiny lobster (*Palinurus vulgaris*)

The spiny lobster (*Palinurus vulgaris*) are decapods crustaceans with 10 pairs of legs. This species lacks pincers, but the defensive spines can be harmful. It is typically found in crevices in rocky habitats or sometimes on stoney substrates. The spiny lobster is targeted as a food species.

Sally Lightfoot Crab (*Percnon gibbesi*)

The Sally Lightfoot crab (*Percon gibbesi*) has a body (carapace) that is about 3 cm wide, the legs have distinctive yellow rings at the joints, and a row of spines along the front of the walking legs. This species is not native to the Mediterranean as it originates from Florida to Brazil and Madeira to the Gulf of Guinea. In the Caribbean it is found living in the spines of amongst sea urchins. It was first discovered in the Mediterranean Sea in Sicily in 1999, and has since been found on the Balearic Islands, Greece, and Libya. In the Mediterranean Sea, it is herbivorous, and typically found living among boulders. This has been described as "*the most invasive decapod species to enter the Mediterranean*", and it is considered to be an indicator of climate change.

Octopus

There are several species of octopus found in the Mediterranean. The most common octopus (*Octopus vulgaris*) is a nocturnal predator, which feeds on molluscs, small invertebrates and fish. The octopus, like other cephalopods, is bilaterally symmetrical, and they have a pair of eyes and four pairs of arms with suckers with two rows of suckers. Unlike other cephalopods, they do not have an internal shell or skeleton, the only hard structure is the mouth (or beak) which is located on the underside at the centre of the arms. This species is usually a greenish brown colour, but they are masters of camouflage, and can change colour depending on the habitat. They are usually found in rocky areas but they can also be found in sandy habitats where they create burrows reinforced by rocks and shells. An octopus burrow is relatively well-camouflaged, but it is possible to spot these by the neat arrangement of stones and shells around the entrance. Octopuses tend to have relatively short life-spans which may be as short as 6-12 months. They breed only once in a lifetime, and both males and females die shortly afterwards. Males die about two months after mating and the females brood the eggs for about 1 month and then dies shortly afterwards. Octopuses are heavily fished in the Mediterranean.

Cuttlefish (*Sepia officinalis*)

The Common Cuttlefish (*Sepia officinalis*) eat small molluscs, crabs, shrimps and other cuttlefish. They are preyed on by sharks, fish and other cuttlefish. It is often observed over sandy habitats, within bays and estuaries. The body is broad but cylindrical, with paired fins which run from the head to the tail. There are 8 arms and 2 tentacles, surrounding the mouth and adjoining the head with large eyes. The colour is variable, but it typically has mottled black-brown stripes on the upper side and a pale underbelly. There is an internal shell which is the cuttlebone that is frequently seen washed ashore. They live for 2

years, and can reach up to 45cm, although the body is more typically 30 cm long (excluding tentacles). They move by jet propulsion, and can eject ink when scared to mask their escape.

Fan mussel (*Pinna nobilis*)

The fan mussel (*Pinna nobilis*) is a large bivalve mollusc, with a pair of triangular-shaped shell valves that can reach 30 cm in length. These huge bivalves live part-buried in the substrate with the wider part of the shell protruding above the surface. Fan mussels can be found in shallow water on coasts sheltered from the waves, to depths as great as 400m. They are threatened by fishing methods that disturb the seabed including trawling and dredging, and populations have a slow recovery time.

Sea-hare (*Aplysia depilans* & *Aplysia fasciata*)

Sea-hares are a type of gastropod (snail-like) mollusc where the shell is hidden underneath the body (mantle), they have a pair of tentacles on the head. There are several species of sea-hare found in the Mediterranean. They are related to nudibranch but they are generally larger. Two of the larger native species of sea-hare found in the region are (*Aplysia depilans* and *Aplysia fasciata*) which can reach 25 cm.

Spotted Sea-hare (*Aplysia dactlomera*)

The spotted sea hare (*Aplysia dactlomera*) is a non-native species that has recently been found in the Mediterranean. It is often yellow to orange in colour, with irregular back ring markings and can reach up to 40 cm in length. Often found in shallow waters (0-3 m depth), in tide pools and on rock or under rocks, and on sand substrates, including sea grass. Occasionally they have been observed up to 40 m depth.

Nudibranch

Nudibranchs are another type of gastropod (snail-like) mollusc, but these lack a shell entirely. These typically small invertebrates range between 2 cm and 6 cm. They have a slug-like body with a pair of tentacles on the head and a ring of feathery gills on the back, and sometimes they have additional appendages along the back. What they lack in size they make up for in colouring, as they are usually brightly coloured.

Starfish

There are many different species of starfish or seastars in the Mediterranean. Starfish are echinoderms, and they have a flattened body with five or sometimes more radiating arms (or rays). The mouth is on the underside along with the tube-feet, which allow the seastar to move along the seabed. Some seastar are voracious predators and they can have significant impact on benthic community structure. They can vary in size, some of the most conspicuous species of seastar in the Mediterranean include *Astropecten araniacus,* which can reach 60 cm diameter, and *Luidia ciliaris*, which can reach 40 cm diameter. Another distinctive species is the Spiny Seastar (*Marthasterias glacialis*), which is covered in small spines as the name suggests.

Urchins

There are many different species of sea urchins in the Mediterranean, and they are found from the shore to great depths. Sea urchins are generally spherical, within a chalky shell-like skeleton covered in mobile spines. The mouth of the urchin is on the underside and the anus is located on the apex of the shell. Sea urchins are grazers and they feed by scraping the fine algal film that forms on the surface substrate. As with other grazers, sea urchins help to create clean patches on the seabed, and space for new benthic organisms to settle. They are important for controlling the assemblage of species found on the seabed and the functioning of Mediterranean rocky reef ecosystems. Sea urchins are preyed upon mainly by fish. If the fish predators are overfished then sea urchin populations can increase rapidly, resulting in overgrazing, which can be problematic in some habitats (e.g. kelp). Similarly, a lack of sea urchins can also be problematic in certain habitats. Sea urchins such as *Paracentrotus lividus* are fished, as they are eaten in several countries within Europe, and urchin caviar (eggs) is considered a delicacy in France.

Cladocora cespitosa

There are several corals found in the Mediterranean but *Cladocora cespitosa* is one of two hermatypic coral (corals which contain symbiotic algae and are capable of reef building). This species does not form reefs but it does forms sizeable colonies up to 50 cm in size on rocky habitats between 1 to 70 metres depth. It may more rarely be found loose and free living, on patches of rubble within seagrass beds. The colonies are formed from small clumps of tubular branches with corallites on the tips of the branches. The corallites are usually brown, and the fine tentacles are extended in daytime.

Oculina patagonica

The coral *Oculina patagonica* is the other hermatypic coral, although it can also be found both with and without symbiotic algae (azooxanthellate). Colonies more typically have an encrusting growth form, or may form low clumps, with short fused branches. It is typically yellow-brown, the corallites are crowded, up to 5 mm diameter with crisp round walls. Most commonly found growing on rock and man-made structures between 0.5 to 10 m depth, it can adapt and survive various environmental conditions. Although it is now described as an endemic species, there has been considerable debate as to whether or not this species is native to the Mediterranean. It was first described from the south-west Atlantic, and was first discovered in the Mediterranean in 1966 around the harbours of north west Italy, and south east Spain. It has since been described from various other locations. It is an "opportunistic dominant settler" overgrowing the calcareous structures of serpulids, vermetids, barnacles, eliminating algae and other soft organisms. It can also out-compete *Cladocora caespitosa.* Threats include bleaching and disease at high temperatures. It is listed as a species of 'Least Concern' on the IUCN Red List, but climate change and ocean acidification may pose a greater threat to this species.

Orange coral (*Astroides calycularis*)

The Orange coral (*Astroides calycularis*) is considered to be a relict species that is endemic in the Mediterranean Sea and adjacent Atlantic waters. It is bright orange and often found in caves, on vertical

walls and small overhangs which are less exposed to light. It's status has not been assessed on the IUCN Red List, but like other corals it is sensitive to damage, and it is considered to be endangered (listed in Annex II of the Barcelona Convention and Annex II of the Bern Convention).

Red sea fan

The red sea fan (*Paramuricea clavata*) has a branching growth form, and is red or violet coloured with brownish colour branch tips. It can grow to 30 height, and is found on rocky substrates below 15 m in depth. The red sea fan is vulnerable to physical impacts due to fishing and climate change, and an indicator of the level of habitat disturbance.

White sea fan

The white sea fan (*Eunicella singularis*) is one of the most abundant and widely distributed sea fans in the Mediterranean. This sea fan has elongated branches, covered in small polyps that are darker than the typically white body due to the presence of symbiotic algae. The sea fan can grow up to 30cm in height attached to rocks below 15 m depth. The white sea fan is vulnerable to physical impacts due to fishing and climate change, and can act as an indicator of the level of habitat disturbance.

Yellow sea fan

The yellow sea fan (*Eunicella cavolini*) has a branching growth form and is yellow in colour. It can grow to 50cm in height and is found on rocky seabeds and in caves in areas of fairly strong currents. The yellow sea fan is vulnerable to physical impacts due to fishing and climate change, and can act as an indicator of the level of habitat disturbance.

Branching sponges (e.g. *Axinella* sp.)

Sponges play an important role in the ecosystem by filtering large volumes of seawater, improving water clarity. However, this also makes them vulnerable to pollutants and other substances in the water. Sponges also provide important habitat for various small marine organisms. There are many different species of sponge in the Mediterranean, some of which are branch-shaped. They tend to grow in shallow water and although most are quite small, some can grow up to 70 cm in height.

Neptunes lace

The bryozoan known as Neptunes lace (*Reteporella grimaldii*) is a particularly delicate species, typically found in crevices in rocky substrates between 1 and 50 m, or within seagrass beds. Bryzoans are important because of their capacity for calcium carbonate production. As they are fragile, they can also provide some indication of the level of habitat disturbance.

Pentapora

The bryozoan *Pentapora* are delicate organisms found in a variety of habitats. Bryzoans are important because of their capacity for calcium carbonate production. They sustain a large part of carbon fixing and biomass production of the communities in which they participate. These can form important components of coralline algal reefs, and may be epiphytes within gorgonian gardens.

Other Species

There is space on this part of the form record the scientific names of the other species of invertebrates that you observe, if you are confident of their identification.

Algal Species

Cystoseira sp.

The large brown algae *Cystoseira* sp. can be used as a bioindicator of water quality, as they do not tolerate polluted waters.

Caulerpa taxifolia

The green alga *Caulerpa taxifolia* is a tropical species that was accidentally introduced to the Mediterranean from an aquarium in Monaco. This non-native species has spread throughout the NW Mediterranean since it was first observed in waters off the coast of Monaco in the mid-1980's. The alga competes with and overgrows native species, and as there are no natural grazers that consume this species, it can spread rapidly.

Caulerpa racemosa

The green alga *Caulerpa racemosa* is a tropical species, also known as the sea grape. The species found in the Meditarranean is non-native, and it was first reported from the waters in Crete, where successful managed to overgrow a *Posidonia* beds within 6 months, resulting in complete shift in the benthic habitat from seagrass to algal meadows.

Other Species

There is space on this part of the form record the scientific names of the other species of algae that you observe, if you are confident of their identification.

Marine mammals

There are an estimated 19 species of cetaceans thought to occur in the Mediterranean. Of these, there are 8 commonly encountered species including: Fin whale (*Balaenoptera physalus*), Sperm whale (*Physeter macrocephalus*), Cuvier's beaked whale (*Ziphius cavirostris*), Striped dolphin (*Stenella coeruleoalba*), Risso's dolphin (*Grampus griseus*), long finned Pilot whale (*Globicephala melas*), Bottlenose dolphin (*Tursiops truncatus*), Common dolphin (*Delphinus delphis*). There are 4 occasional species: Minke whale (*Balaenoptera acutorostrata*), Killer whale *Orcinus orca*), False killer whale (*Pseudorca crassidens*), and Rough toothed dolphin (*Steno bredanesis*). The remaining 6 species have only been sighted occasionally (among them the Humpback whale *Megaptera novaeangliae*). The only pinniped to be found in the region is the Mediterranean Monk Seal (*Monachus monachus*), which is now very rare and listed as an endangered species.

Sea turtle

There is only one species of sea turtle known to occur in the Mediterranean, which is the oceanic Loggerhead turtle (*Caretta caretta*). It can reach around 90 cm long when fully grown. Sightings are extremely rare. This species is listed as 'Endangered' on the IUCN Red List.

Fishing activities

Fishing activities may include small-scale coastal fishing targeting a range of fish and crustaceans using lines, traps and nets or recreational and sport fishing which tends to target large pelagic species such as tunas, marlin and swordfish. Intensive fishing activities result in declines in abundance of the target species as well as other species, which may be caught accidentally and also damage seabed habitats such as seagrass. Overfishing is a problem in the Mediterranean, where over 50% of fish stocks are overfished.

Spearfishing

Spearfishing is carried out using elastic powered spearguns and slings or compressed gas pneumatic-powered spearguns to strike the hunted fish and can be done using snorkelling or SCUBA diving. Spearfishing is highly regulated; it is banned in some areas; in some countries a licence is required or it may be only allowed when free diving (not with SCUBA) and only during the day time.

Jellyfish bloom

Several species of jellyfish occur naturally in the Mediterranean. Often these may be seen as individuals and rarely in groups. Globally, over the past 10 years, there has been an increase in the frequency of reports of 'jellyfish blooms', when there are swarms of jellyfish in the water at the same time. Jellyfish blooms can present a nuisance for swimmers, and pose a potential health hazard when certain toxic species are involved. Such blooms also cause problems for fishermen, as they clog nets thereby deterring fish and consume fish larvae. Jellyfish in large numbers can also clog the inlets underwater pipes. The increased frequency of jellyfish blooms, and the synchrony of such events in the

western and eastern Mediterranean indicate a potential phase shift. The cause of these blooms is uncertain and may be linked to overfishing, coastal habitat degradation, contaminated run-off and climate change, or a combination of these factors. For further information see:
http://www.ciesm.org/marine/programs/jellywatch.htm

Algal bloom

An 'algal bloom' occurs when there is a large accumulation of small algae (phytoplankton), macroalgae and occasionally heterotrophic protists in the water. There are many species of phytoplankton that can form blooms. Some species can cause the water to change colour, and cause 'red tides', 'brown tides', or 'green tides'. Other species produce toxins that are poisonous to fish (and humans if they consume the fish) and these are called 'harmful algal blooms (HABs)'. Sometimes create a scum or foam on the sea surface, which can also cover beaches. Algal blooms can occur naturally in response to seasonal changes in the availability of nutrients in the water that favour cell. They can also occur as a result of nutrient enriched run-off from the land, with high concentrations of nitrates, phosphates, from human waste water or from agriculture (fertililzers). Massive algal bloom have occurred in the Mediterranean since 1980s. When the bloom ends, the algae die and sink to the seabed. The decomposition of the algae removes oxygen from the water and can cause 'eutrophication' and result in the death of other organisms living on the seabed or in the water column.

Marine litter

Marine litter is a global problem. Man made synthetic materials whether they float, sink or remain suspended in the sea, not only look unsightly, but can pose a threat to many species of wildlife. It is estimated that 8 million items of marine litter enter the oceans every day, from the land or thrown overboard from ships. Another estimate is that there are over 13,000 pieces of plastic litter floating for every square kilometre of ocean surface. A survey in the Mediterranean between 2006 and 2011 identified that shoreline recreational activities contributed the bulk (55 %) of beach litter (plastic bottles, plastic bags, drink cans, glass bottle, cups plates, food wrappers, pull tabs) while the remainder (45 %) of rubbish items were from smoking related activities (e.g. cigarette filters, cigar tips). Marine litter was mainly composed of plastics (52 %), wood (31 %) such as crates, metal (15 %) such as drums, clothing (1%) and paper such as cardboard boxes (< 1%).

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