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RICERCA MARINA



**NEW SPECIES IN THE ADRIATIC SEA:
WHAT TO DO, HOW TO RECOGNIZE THEM**
A guide for small-scale
and sport fishing

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Are you a fisherman?

Fill out the questionnaire at the end of the booklet, or the online version
...it only takes five minutes

<http://goo.gl/forms/5V7R1zx6Fm>

...THERE WEREN'T ANY BEFORE

Are you an expert fisherman? So when you say, 'I've never seen this before', it's worthwhile to stop and listen to you. Some of you had probably happened to catch a new fish, others will have noticed that some species have increased their number in recent times.

Where do these organisms come from? How is it possible that a species has increased so suddenly and what is happening to our sea?

The problem is complex but also under the eyes of so many, who like you, live in close contact with the sea and its inhabitants. Some species are actually rare, and that's why we have never seen them before, others have arrived after a long journey, transported by the ballast water of ships, through the aquaculture industry or with the aquarium trade; others are tropical species that have crossed the Suez Canal. Then there are Atlantic species that enter through the Strait of Gibraltar and also native species of the Mediterranean that are expanding their geographical distribution northwards due to the rise in water temperature. Documenting these arrivals is of great importance. Indeed, these observations, often occasional, are actually signals that reflect the epochal changes in both marine and terrestrial environments worldwide. Furthermore, the increase in commercial traffic is causing no less than a redistribution of living species on the planet. Many of these introductions are harmless and the organisms may succumb soon after their release in the new environment. Some species, however, are able to settle, developing in great numbers with drastic ecological consequences and serious economic impacts.

NON-INDIGENOUS SPECIES AND PUBLIC PARTICIPATION IN SCIENTIFIC RESEARCH

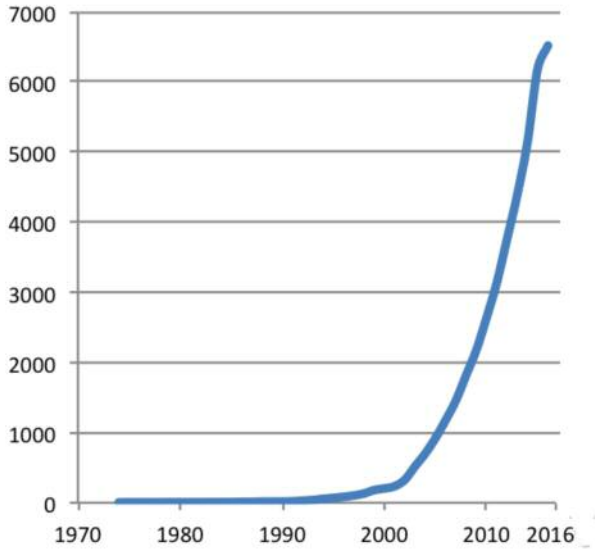
Only recently, the scientific community has begun to understand the value of public participation in scientific research. That's because of the emergence of phenomena such as biological invasions, involving huge natural spaces that are very difficult to monitor with the traditional methods.

An odd species, never seen before, always brings about some curiosity, but how do we detect these newcomers? It may seem strange, but usually, the first to discover these 'novelties' are not the 'scientists' but those who are most often in contact with the natural environment: fishermen, scuba divers and in general all those people who spend a good amount of time every day at sea. People interested in deepening their knowledge, or simply stimulated by curiosity, understand the importance of these findings, take a picture of the specimen, preserve it and in some cases contact an expert.

Thus our question is:

'If fishermen are so important for monitoring this phenomenon, why not involve them officially?'

As a matter of fact, the collaboration between researchers and local communities provides tremendous opportunities for expanding our understanding of natural phenomena. There are several possibilities to do so. A first approach, perhaps the best known, is that of citizen science. In this case the observations are collected in a voluntary way from enthusiasts and amateurs, following a guide or precise instructions given by professional researchers. These projects have been very successful for species of public interest that are easily recognizable, such as jellyfish or birds. Nevertheless, in the last ten years another kind of approach has emerged, one that takes advantage of the knowledge already in the possession of those who live in close contact with nature, such as fishermen, the primary users of the sea. This knowledge, technically known as '*Local Ecological Knowledge*' (LEK) is an undisclosed opportunity for understanding large scale changes in the natural environments and for retrieving historical information that would otherwise be lost forever.



The LEK or *Local Ecological Knowledge* can be defined as the ‘knowledge that local populations have on local ecosystems’. Only recently has the scientific community started to officially exploit this valuable source of information. The graph shows the rapid increase of scientific studies that have used this approach throughout the world.

INTERCEPT AND RESPOND: EARLY DETECTION AND RAPID RESPONSE

If we take the case of biological invasions, the collaboration between researchers and local communities is a crucial instrument, not only for monitoring the phenomenon but also for promptly responding to new arrivals and limiting potential impacts. Unfortunately, managing invasive species in the marine environment is much more complicated than in terrestrial environments. Nonetheless, to act quickly means a higher probability of success. In order to disseminate knowledge about non-native species and to increase the possibility of monitoring their geographic expansion, the European project BALMAS (Ballast Water Management System for Adriatic Sea Protection) invites both professional and sports fishermen to share their own observations. The approach presented in this booklet is part of a broader process involving fishermen from the entire Adriatic Sea, in Albania, Montenegro, Slovenia, Croatia, Bosnia, Italy and from other Mediterranean countries like Greece, Tunisia and Cyprus.

NEW SPECIES IN THE ADRIATIC

Witnessing the emergence of a new species into a new environment is something that always arouses curiosity, but also is cause for concern about the possible consequences on the fragile natural equilibrium. As we said, only in some cases do these biological introductions lead to the development of invasive and harmful populations, but this may happen both for non-indigenous species introduced directly by humans, and those native species that are expanding geographically and may explode with great abundances [native invaders].

In order to give some example of 'new' species for the Adriatic Sea, we have chosen to focus on some recent cases, and especially on some species of fish that more directly involve sport and small-scale fishing. We will also take into consideration two crabs, one kind of seaweed and a snail that deserve our full attention.

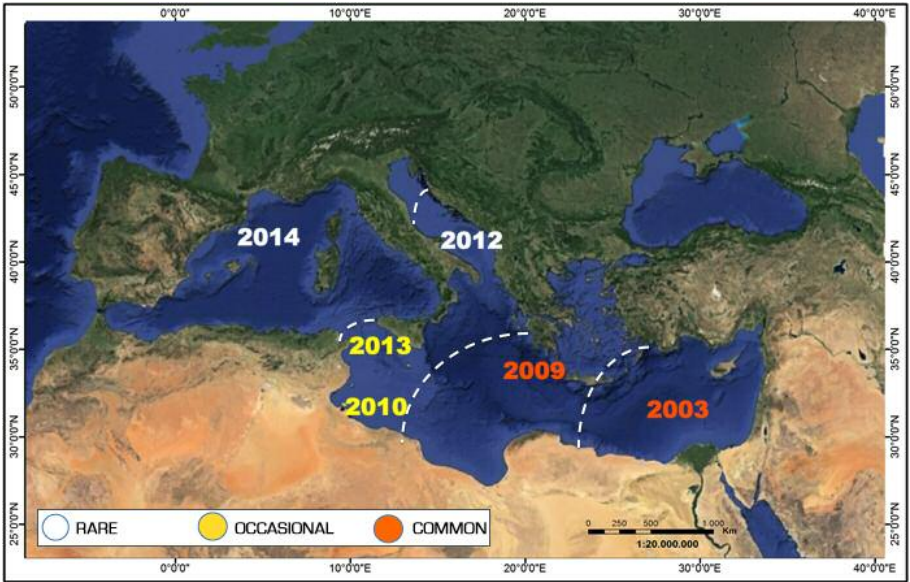
THE SILVER-CHEEKED TOADFISH (*LAGOCEPHALUS SCELERATUS*)

The silver-cheeked toadfish *Lagocephalus sceleratus*, is a tropical species that is one of the most invasive for the Mediterranean Sea and Europe. It entered the basin in 2003 from the Red Sea through the Suez Canal, soon afterwards colonizing much of the eastern basin of this sea. Today the species is rapidly expanding westwards and its presence in Italian waters was recorded for the first time in 2013, in the island of Lampedusa. Since then, other specimens have been caught in the Strait of Sicily, along the southern Adriatic coasts and in Spain. It can be easily distinguished from other pufferfish for the presence of dark spots on its back and for a silver band which runs along both flanks. Due to the high content of tetrodotoxin, the species is highly toxic for human consumption and it has already caused severe poisoning in countries of the eastern Mediterranean, some of them being fatal.

- Not edible, toxic for human consumption
- Beware of bites, they are very dangerous
- Non-indigenous species
- Red Sea origin through the Suez Canal






The silver-cheeked toadfish *Lagocephalus sceleratus* is an invasive species, highly toxic for human consumption. It can be easily distinguished from other pufferfish for the silver band on both flanks and for the presence of dark spots on its back. ISPRA has launched an alert campaign and any sightings of this species should be sent to the address pescepalla@isprambiente.it



Geographic expansion and current levels of abundance of the silver-cheeked toadfish in the Mediterranean Sea.

THE DUSKY SPINEFOOT (*SIGANUS LURIDUS*)

Rabbitfish (siganidae) are herbivorous species distributed in tropical and subtropical waters of the Indian Ocean and Pacific Ocean. Some of these species are used for food consumption and cultured in various countries of the world. In the Mediterranean, two species of Red Sea siganids entered through the Suez Canal: *Siganus rivulatus* and *S. luridus*. The dusky spinefoot *S. luridus* has reached some islands of the Strait of Sicily and it has recently appeared along the eastern Adriatic coast, in Albania and Croatia.

			<ul style="list-style-type: none">• Edible but of low quality• Poisonous spines, punctures by them can be very painful• Non-indigenous species• Red Sea origin through the Suez Canal
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The dusky spinefoot *Siganus luridus* is a highly invasive species. Beware of its spines, they can inflict very painful punctures.



The dusky spinefoot *Siganus luridus*: detail of the first dorsal spine, hidden under the skin.

THE MARBLED SPINEFOOT (*SIGANUS RIVULATUS*)

The marbled spinefoot *Siganus rivulatus* can be distinguished from the dusky spinefoot *S. luridus* by the elongated shape of its body, the caudal fin that is forked (and not truncated) and for a lighter color pattern, often characterized by yellow stripes that run parallel along the lower half of its body. It also is a herbivorous species, which has been recently sighted in Adriatic waters (in Croatia, Montenegro and Albania). This species is capable of developing abundant populations with considerable impacts on coastal habitats.



			<ul style="list-style-type: none">• Edible but of low quality• Poisonous spines, punctures by them can be very painful• Non-indigenous species• Red Sea origin through the Suez Canal
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The marbled spinefoot *Siganus rivulatus* is a highly invasive species. As in the case of the dusky spinefoot, attention must be paid to the poisonous spines.

THE BLUESPOTTED CORNETFISH (*FISTULARIA COMMERSIONII*)

The bluespotted cornetfish *Fistularia commersonii* is a tropical species, native to the Indian Ocean and the Pacific Ocean, which invaded the Mediterranean Sea in 2000, entering through the Suez Canal. It is a voracious predator that mainly feeds on small fish but also on crustaceans and molluscs. It has been defined as one of the most invasive species of the Mediterranean and Europe also for the speed of its geographical expansion, which has brought it to the entire Mediterranean Sea in less than 7 years after its first sightings. It can be easily recognized by its elongated shape, its typical long snout and for a long filament at the end of its tail. This species has been observed occasionally in the Adriatic, although only along its eastern side. It doesn't represent a hazard for human health and its meat is good to eat.



		<ul style="list-style-type: none">• Good to eat• Non-indigenous species• Red Sea origin through the Suez Canal
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The bluespotted cornetfish *Fistularia commersonii* is a highly invasive species. It is characterized by an elongated body, a long snout and a long filament that extends beyond the caudal fin.

THE BLUEFISH (*POMATOMUS SALTATRIX*)

The bluefish is a voracious predator, distributed across all the tropical and subtropical waters of the globe and in the Mediterranean. It is not an exotic species but in recent years this fish has expanded its distribution northward, developing abundant populations in all the Adriatic coasts. Young fish can form large schools and intensively prey on small coastal fish. This species is very well-known among anglers for its aggressiveness and combativeness. Those Adriatic fishermen who have years of experience, have witnessed this species appearing in their catches and then becoming more and more abundant. We do not yet know the consequences of the expansion of the bluefish population and the effects of both predation and competition with other predators (such as the sea bass) need to be studied in depth.

		<ul style="list-style-type: none">• Good to eat• Sharp teeth, beware of its bites
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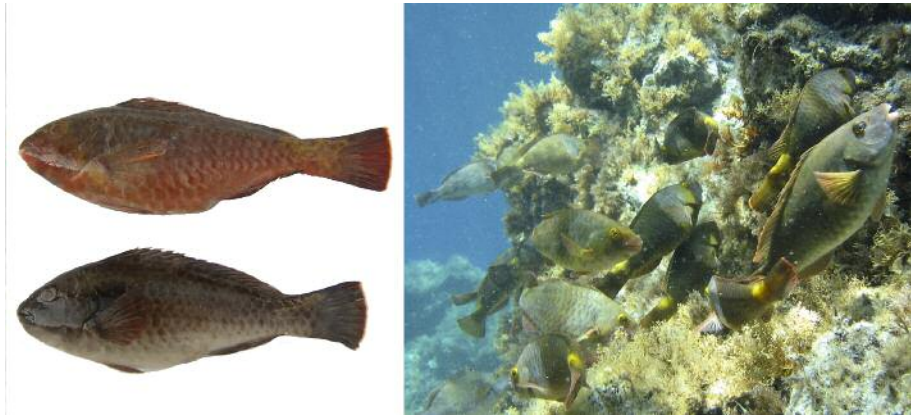
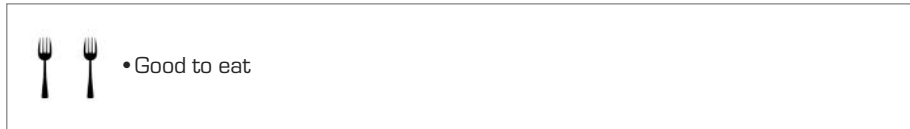


The bluefish *Pomatomus saltatrix* is a native species of the Mediterranean that has rapidly spread through the entire Adriatic Sea. It is a very voracious predator: on the right, the typical bite left on its prey.

THE MEDITERRANEAN PARROTFISH (*SPARISOMA CRETENSE*)

Contrary to what we often hear, the Mediterranean parrotfish is not an exotic species but (as its name says), typical of the Mediterranean and particularly abundant within the warmest areas of this basin such as the North Africa coasts and in Greece. It is a coastal species, strictly herbivorous, that also can be found along the eastern Atlantic coast, from Portugal to Senegal. Due to its affinity for hot waters, many researchers consider this species as an indicator of global warming.




As a matter of fact, individuals of this species have been recently observed along the Adriatic coasts, particularly along the southern areas, in Apulia, Albania, Montenegro and Croatia. The ancient Romans considered it to be one of the most delicious fish of the Mediterranean and in places like the Canary Islands or the Azores, the species is highly prized, while in Italy the parrotfish has very little commercial interest.



The Mediterranean parrotfish *Sparisoma cretense* is a native species of the Mediterranean. Males and females may have different colors. The bright red color is displayed by female individuals while males are often grey, clearer in the ventral part of the body.

THE ATLANTIC BLUE CRAB (*CALLINECTES SAPIDUS*)

The Atlantic blue crab *Callinectes sapidus* is a well-known crustacean of the Portunidae family, also known as swimming crabs. Originally distributed across the western Atlantic coasts and the Gulf of Mexico, it is a species much appreciated for its culinary and economic importance. From the beginning of the last century and due to repeated and independent introductions through commercial ships, the blue crab has invaded the coasts of many countries in the Baltic Sea, Black Sea and Sea of Azov and at least 12 countries of the Mediterranean. The first Mediterranean record of this species dates back to 1948 (Venice). Yet, the ecological consequences of this introduction are not well understood and we have limited information on its distribution and abundance in the Adriatic Sea.

			<ul style="list-style-type: none">• Good to eat, with very prized meat• Like all large crabs, one must be careful of the pincers• Non-indigenous species• Atlantic origin, entered into the waters through the ballast waters of ships
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The blue crab *Callinectes sapidus* is an Atlantic species that entered into the Mediterranean Sea from the Atlantic Ocean probably with ships' ballast waters. The specimen in the photo was captured in the port of Ancona, Italy.

THE SALLY LIGHTFOOT CRAB (*PERCNON GIBBESI*)

The Sally Lightfoot crab is a crab of the Plagusidae family, native to the tropical and subtropical coasts of the Atlantic Ocean. It was reported for the first time in the Mediterranean in 1999, from the island of Linosa and then it rapidly expanded all over the basin, with some recent sightings in the Adriatic Sea. At least two possible introduction vectors have been hypothesized for this species: transport by the ballast waters of ships or passive transport of larvae or adult individuals through the Strait of Gibraltar. The species is harmless and it is strictly herbivorous. It can be easily recognized by its flattened and disc-shaped carapace and its red-brownish color with bluish veins. It has a marked preference for artificial rocks, such as those that make up breakwaters and jetties. It hides in the crevices and gaps at shallow depths and is able to move very quickly over the rocks.



- Non-indigenous species
- Atlantic origin



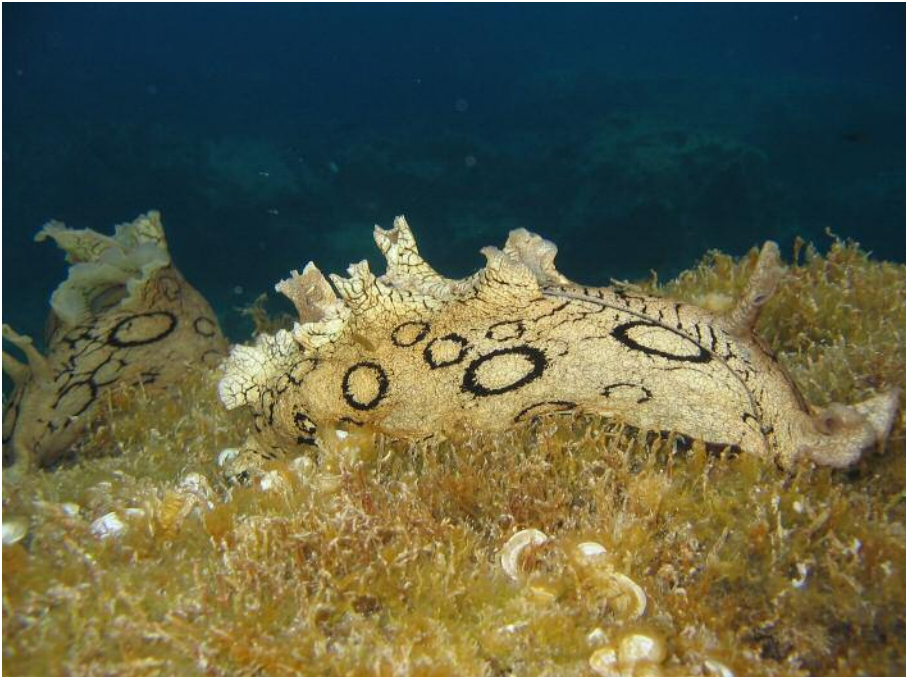
The Sally Lightfoot crab, *Percnon gibbesi* is an invasive species of Atlantic origin. The lower pictures below show a male specimen.

THE SPOTTED SEA HARE (*APLYSIA DACTYLOMELA*)

The spotted sea hare is an opisthobranch gastropod mollusc belonging to the anaspidea order, a large snail without shell that can grow to 20 cm in length. This species is widespread in the tropical and subtropical waters of the Atlantic Ocean and very common in the Canary Islands. It has been recorded for the first time in the Mediterranean in the early 2000s and has been observed only occasionally along the Adriatic coasts. Some researchers do not consider it an actual non-indigenous species, as it might have entered by natural dispersal through the Strait of Gibraltar. If disturbed, the spotted sea hare may emit a repellent purple liquid.



- Not edible
- Non-indigenous species
- Atlantic origin



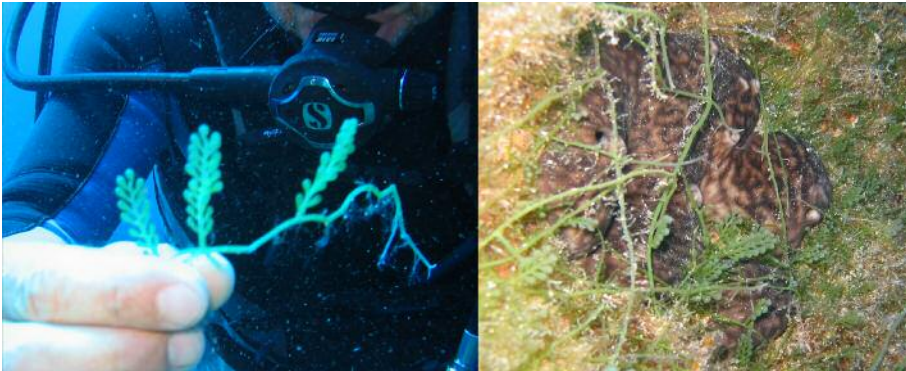
The spotted sea hare *Aplysia dactylomela*. It is easily distinguished by its yellowish color with dark rings of various sizes.

CAULERPA CYLINDRACEA

Caulerpa cylindracea is a highly invasive green seaweed. It can be easily recognized by the structure of its thin rhizoids and by the form of small “balls” on its branchlets. In recent years it has spread greatly over the Mediterranean and in all the major islands. The species is native to southwestern Australia and it seems to have entered the Mediterranean through the ballast waters of ships. It can grow extensively, developing massive algal beds with severe impacts on organisms that inhabit the sea bottoms. Some species of *Caulerpa*, such as *C. lentillifera* and *C. racemosa*, are used for human consumption in countries such as Japan or in Indonesian cuisine. However, these algae produce substances such caulerpin and caulerpicin that make them slightly toxic for consumption. For this reason, we do not recommend the use of this seaweed for alimentary purposes.



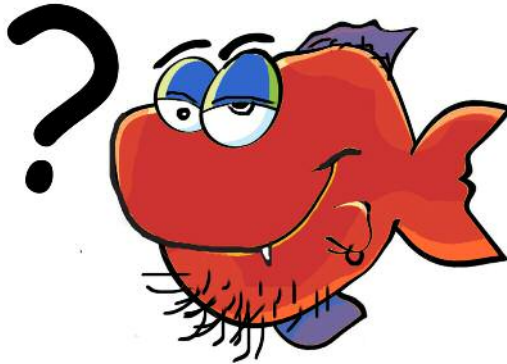
- Not edible
- Non-indigenous species
- South-western Australia origin, entered through ballast waters



Caulerpa cylindracea is one of the most invasive kinds of seaweed in the Mediterranean. In the picture on the right, the species grows, covering a sponge.

THE 'QUESTION MARK' SPECIES

As we said, a species may seem 'strange' because it does not belong to the environment and biotic communities we are used to interacting with on a daily basis. Some of these organisms came from remote places, perhaps on board big ships. Some biologists are working on putting a name to these new arrivals and identifying their origin. If you are an experienced fisherman and you have caught a species that you do not recognize, be careful, it could be a new invader.



When a fisherman who has dedicated many years at sea catches a species that he has never seen before, this deserves our full attention. Documenting and sharing these occasional captures with researchers is a very effective way to have early detection of the introduction of new species and to intercept potential invaders.

CONCLUSIONS

What should we do? The relationship between our species and the natural environment has irreversibly changed. Observing with watchful eyes, understanding the fragility of the ecological balance, sharing our experiences with other people comprise the basis of an ideal social-environmental system. The fisherman is not only an operator who takes resources but is a resource himself, as the first expert, who may be a responsible actor on the front line for the protection of the sea. As for the most invasive species, such as the pufferfish, many Mediterranean countries have launched information campaigns and actions of population control with the involvement of fishermen. Thus, the daily cooperation between fishermen and researchers represents a powerful tool for understanding and at the same time managing invasive species in the best possible way. A species not recognized by those who have lived for many years in close contact with the sea is a species that deserves special attention because it could be a recent introduction. If you catch something that seems strange, new or that has never been seen before, do not throw it back into the sea but keep it, take a picture and contact us immediately. The fish and other organisms that we have illustrated in this booklet are just a small example of a much larger list that is the product of the combined effects of the introduction of non-indigenous organism and global warming. The BALMAS approach used to create synergies between fishermen and researchers is that of dialogue. A mutually beneficial exchange that will make early detection of non-indigenous species possible, reconstructing historical changes and at the same time disseminating information on the rapid and worrisome alterations in marine biodiversity at the beginning of the third millennium.

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Have you observed species that were not present before? Some of these organisms come with ships, others may enter from the Red Sea through the Suez Canal, others are native species that are expanding northwards. Please help us try to understand what's going on in our sea.

Date..... Age (years)..... Sex M F

When did you first start fishing? (year)

Sports fisherman Professional fisherman Diver

Preferred fishing location.....

Fishing gear you use most frequently (you can indicate more than one)






- Only diving and/or underwater pictures
- Spearfishing
- Gill nets
- Seine or dragnet fishing
- Traps
- Angling
- Trawl fishing
- Other (specify)

Have you ever fished in the proximity of a harbour?

YES NO which harbour?.....

Have you ever caught species that were not present before in your fishing location?

YES NO

	 ATLANTIC BLUE CRAB <i>Callinectes sapidus</i> Exotic species, Atlantic origin	 SILVER CHEEKED TOMFISH <i>Apogonoides melanocephalus</i> Exotic species entered from the Suez Canal	 BLUESPOTTED CORNETFISH <i>Ectopristia marginata</i> Exotic species entered from the Suez Canal	 DUSKY SPINEFOOT <i>Sparus aurata</i> Exotic species entered from the Suez Canal	 BLURFISH <i>Physostomus holohir</i> Native species that expanded northwards
Have you ever seen it?					
Since when? (year)					
When and where?					
Current abundance (from 0 to 5)*					

* 0, ABSENT; 1, RARE (once in a year); 2, OCCASIONAL (several times a year); 3, COMMON (regularly in a year); 4, ABUNDANT (regularly and abundant); 5, DOMINANT (always with great abundance)

Other relevant information

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To send the questionnaire:
take a picture of it and send it to lek@isprambiente.it

Do you have pictures of non indigenous species? Contact us!

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FIND THE QUESTIONNAIRE ONLINE AT:
<http://goo.gl/forms/5V7R1zx6Fm>

