Sven Gehrmann

Fire! In the Wadden Sea...

Or what the fauna of the North Sea urgently wants to tell us

Content

Forbes’s Squid

Sagittate or Arrow Squid

Common Cuttlefish

The Cuttlefish`s New Nursery

Phylum *Cnidaria* – Cnidarians

Orange Anemone

Cup Coral

Phylum *Ctenophora* – Comb Jellies & Sea Gooseberry

Phylum *Annelida* – Annelid worms

Subclass *Errantia* – non sessile annelid worms

Catworm

King Ragworm

Sea Mouse

Subphylum *Crustacea* – Crustaceans

Subclass *Copepoda* - Copepods or Ruddercrabs

Order *Cumacea* – Hooded Shrimps

Infraclass *Cirripedia* – Barnacles & Goose Barnacles

Order *Decapoda* - Decapod Crustaceans & Chamaeleon Prawn

Processa Shrimp

Oriental Glass Shrimp

Autochthonous glass shrimps of the genus *Palaemon*

Aesop Prawn

Shore Crab

Mediterranean Green Crab

English Channel Crab

Linaresi`s Long Legged Spider Crab

Atlantic Spider Crab

Marble Swimming Crab

Arch-Fronted Swimming Crab

Velvet Swimcrab

Pennant`s Swimming Crab

Strigose Squat Lobster

Dwarf Hermit Crab

Common Hermit Crab

Shore crabs from the northern Pacific

Great Spider Crab

Edible Crab

Phylum *Echinodermata* – echinoderms

Common Starfish

Green Sea Urchin

Edible Sea Urchin

Spiny Starfish

Subphylum *Tunicata* – Tunicates

Yellow Sea Squirt or Sea Vase

Star Squirt

Botrylloid

Folded Sea Squirt

Class *Elasmobranchii* – Rays & Sharks

Spiny Dogfish

Dogfish or Small Spotted Catshark

Tope Shark or Sweet William

Electric Marbled Ray

Broadnosed Skate

Thornback Ray

Stingray

Class *Actinopterygii* – Ray Finned Fish

Garfish or Seaneedle

Tompot Blenny

Twaite Shad

Herring

Sprat

Sardine or Pilchard

European Anchovy

Sand-Smelt

Sea Trout

Atlantic Salmon

European Smelt

Whiting or Merlan

Atlantic Cod

Saithe

Pouting or Bib

Burbot

Five-Bearded Rockling

Four-Bearded Rockling

European Hake

Ocean Sunfish

Thicklip Grey Mullet

European Seabass

Threespine Stickleback

Sea Stickleback

Short-Snouted Seahorse

Greater Pipefish

Lesser Pipefish

Snake Pipefish

Red Scorpionfish

Blackbelly Rosefish or Bluemouth

Red Gurnard

Tub Gurnard

Grey Gurnard

Striped Red Mullet

Atlantic Horse Mackerel

Morocco Dentex

Salema

Gilthead Seabream

Lesser Weever

Greater Weever

Atlantic Bonito

Atlantic Mackerel

Goldsinny

Instead of a preface - some science fiction from the ancient world

"And the second angel sounded, and something like a great mountain burning with fire was cast into the sea; and the third part of the sea became blood.
And the third part of the creatures which were in the sea, which had life, died, and the third part of the ships were destroyed..."

(Revelation 8, verses 8 and 9, after the Elberfeld Bible translation of 1905)

Note to this: This biblical text from the most recent book of the Bible was most likely written between the years 81-96 AD during the time of the Roman Emperor Domitian. If we look at the event described here as a gradual process, then the destruction of the ships could indicate that fishing boats will in future rot in the harbours for lack of catchable quantities of fish... Perhaps the last chapters of the New Testament should in future be interpreted much more ecologically than has been done in the past. And if the God of the Bible is indeed a loving God, then he will ultimately not punish human beings for their sacrilegious actions. No, he simply withdraws and leaves them to the consequences of their own actions... I wonder if they would then learn something from this?

Introduction to a very complex topic...

There are warm times in the southern North Sea. Now, in 2020, the heat wave below sea level, which the majority of our population has never seen before, has reached a completely new quality for the first time. This is because the season known as "winter" from the days of the fathers has apparently been completely absent here since January 2020. On 10.Jan 2020, for example, the German Federal Maritime and Hydrographic Agency (BSH) reported a temperature of 10-11° Celsius off the East Frisian Islands.

Although the water temperatures near the coast were somewhat lower in the single-digit range, they were still so high that it was still possible to catch small sea creatures in the tidal flats with the frame landing net, which otherwise prefer to spend the winter in deeper water zones. And also the glass shrimps of the harbour sheet piles were still present. Since January 2020, state authorities should actually have had red warning lights shining all day long. And a monotonous, muffled howl of alarm should warn the general public of the impending climate disaster. But still nothing happens. When talking to employees of national park institutions, one hears remarks like: "It is not our job to make political statements. We only exhibit something here, and the visitor can then form his own opinion.” Great, I think. Because when I look at the aquaria of this "environmental exhibition", for example, I notice that although the well-groomed animals were carefully labelled. But that there's no indication of how they relate to the climate change. Moreover, the aquaria all look wonderfully tidy and clean, creating the illusion that you are looking at

an ideal and intact environment. But that most of the animals shown here actually live on the seabed on a large garbage dump, which consists of PVC, PCB, net remains, car parts and other garbage, cannot be seen here. As an uncritical visitor of such an exhibition you go home and only think: "Oh great, everything is fine again in the North Sea, thanks to the National Park". Really? In this book, I'm going to point out some uncomfortable things. You'd better prepare yourself for something that may blow apart your former imaginations...

Retrospective – ja so war es in der „guten“ alten Zeit

1983, Borkum: I, then 14 years old, got the chance of a lifetime: I was allowed to go out with a real professional fisherman. To catch shrimps! I remember how we lowered the net on 07.07.1983 at clear sight off the bird island Rottum. Two mighty beam trawls dragged evenly over the ground on each side of the ship. After an agonizing three quarters of an hour, the mighty beam trawls were caught by a winch. Full of joyful anticipation I hopped over the deck and - much to the annoyance of the fisherman - almost got the beam trawlers on my head. The net was full of true shrimps, also known and dealt as "crabs". Great pipefish and tub gurnards particularly fascinated me at that time. We also caught lots of flatfish of all sizes, various eels and soles, the latter two of which we boiled fresh on board. I have never eaten better fish! And today?

2003, Baltrum: A short holiday with the family. Recently, giant oysters have been appearing here in the waddens; occasionally on stones. It's April, the sun shines so much that the islanders have to turn on their sprinklers, because the grass on the island starts to wither. Furthermore, I find **Pennant`s Swimming Crabs (*Portumnus latipes*)**, which had their origin off north-west African coasts, washed up on the beach. All females, that came to the southern North Sea to reproduce here...

2011, Norddeich: In the harbour basin small fishes swim on the surface, just about two centimetres long. An investigation shows that these are juvenile **Sea Bass (*Dicentrarchus labrax*)**. Not a single flatfish can be caught with the landing net in the local tidal flats... The pier is

covered with **Pacific Giant Oysters (*Magallana gigas*)**. The once common **Blue Mussels (*Mytilus edulis*)** have become a scarce commodity here...

2012, Baltrum: It's midsummer in August. At high tide, anglers are still standing on the groynes. What they do catch here? Sea bass; the island record is something about 70 centimetres long...

2012, Norddeich: This time no sea bass in the harbour basin, but small flatfish in the waddens... At least; but only a few.

2013, Norddeich: With the bait sink net only little animals can be detected in the harbour basin. But also an imported shrimp from Korea, the **Oriental Glass Shrimp, *Palaemon macrodactylus.***

2014, Norddeich: And again in April a shrimp trawler brings along egg-bearing females of the subtropical **Arch Fronted Swimming Crab *Liocarcinus navigator***. The North Sea is too warm for the season. Summer?

Spring 2015 and 2016, Norddeich: The shrimp trawlers catch tope sharks, broadnosed skates, anchovies... All immigrants from the English Channel.

The Winter 2014/2015 was once again much too warm for our latitudes...

2017, Filthy weather in East Frisia: Not really a summer, it's constantly muggy or rainy, the farmers have many problems to be able to harvest anything at all... The by-catches of the fishermen are very different, certain otherwise common species are rare...

2018: Heat wave! Many otherwise common fish species were hardly caught by fishermen in summer. Because with a water temperature of 22° Celsius in the southern North Sea, they prefer to stay in deeper areas where no trawlers fish... In the Baltic Sea: 25° Celsius and vibrio alarm! In addition to this, one could observe more jellyfish than usual. Have they decimated the fish brood?

2019: Almost the same as 2017, only considerably warmer. In summer, the tub gurnards and other otherwise frequent by-catches are missing...

On 31.Dec 2019 it was still possible to catch true shrimps in the tidal flats of Neßmersiel. The North Sea is too warm. Winter? What is winter?

2020: January. Temperatures up to the double-digit range. Spring bloomers already have buds. There are already daisies... The season "winter" seems to be gone this year in East Frisia, Lower Saxony. The shrimp fishermen go out, although they usually take a winter break at this time of the year. And they bring unusual creatures into the harbour, which is evidence of unbelievable things. As we will see in the following... Some of these catches are inconspicuous and small, others are almost screamingly colourful. As if Mother Nature wanted to send us a brightly coloured warning before it's too late...

Uncomfortable Facts...

1. **Temperatures in the North Sea (i.e. the German Bight)** According to the Federal Maritime and Hydrographic Agency (BSH), the average water temperature of the North Sea in 2017 reached 10.9 degrees Celsius, only slightly below the 2016 value of 11.0 degrees. This was the second highest value since 1969, and only in 2014 was the water even warmer at 11.5 degrees Celsius. At the moment (January 2020) we have temperatures between 10 and 11 degrees Celsius in the southern North Sea off the East Frisian Islands... You can catch true shrimps in the waddens, which should actually be hibernating in deeper water layers... The "winter" season does not seem to be taking place in the southern North Sea at all at the moment...

2. **On 18.01.2020 at the internet provider GMX it could be read that...** ...a heat wave in the ocean caused a mass death off the American coast of the USA. Researchers from the United States called the stream of excessively warm seawater that stretched from Alaska to the Baja California a "blob".

This caused the death of several ten thousand of birds in the Pacific, but also millions of starfish. The warming of the sea water favoured the reproduction of viruses and epidemics, which are responsible for the death of these animals. Climate change could make such deadly heat waves in the sea more and more frequent. Incidentally, the seabirds simply starved to death because the warm seawater caused their otherwise abundant prey to disappear...

Scientists estimated the total number of dead seabirds at about one million...

They assumed that the "sea heat wave" had reduced the quantity and quality of the plankton, so that the number of fish living on it was greatly reduced.

In addition, the metabolism of fish in warmer water was said to have become faster. As a result, the predatory fish would have needed much more prey than usual due to the resulting higher energy conversion, thus further reducing the number of available prey fish for seabirds. In addition, other creatures had also been affected by the problem of ocean warming. Among others, "only" about 100 million cods have died. And many whales also suffered from the consequences of this dramatic ocean warming.

3.) Sea heat waves caused by a climate warming up

These already existed in the Tasman Sea and in other regions, such as the Australian Barrier Reef or on the coasts of South America, where the phenomenon has been known for many years under the name ***El-Niño****.

In 2018, these phenomena could also be observed very clearly in the German North Sea and in the southern Baltic Sea... In summer 2018, the North Sea became 22° Celsius warm, while the southern Baltic Sea even reached temperatures of up to 25° Celsius. These were values as they are usually measured in the Mediterranean Sea...

4.) The warming up of the oceans is accelerating more and more...

Scientists have calculated that in 2019, the world's oceans will be warmer than at any time since the global survey began. They also warned in the journal "Advances in Atmospheric Sciences" that climate change is accelerating the warming up of the oceans. According to the report, the past ten years have seen the highest ocean temperatures since the 1950s, with the last five years also being the

warmest. In 2019, the average sea temperature down to a depth of two kilometres would be about 0.075° Celsius above the average from 1981 to 2010.

5.) A preliminary review...

This enormous amount of energy in the form of heat emitted into the oceans by man over the past 25 years is equivalent to the energy discharge of 3.6

billion(!) atomic bomb explosions of the size of the atomic bomb, that was detonated over the Japanese city of Hiroshima during World War II.

*Spanish = the Christ Child. The phenomenon of the warming of the Pacific Ocean off the coast of Peru from 24° to 26° Celsius has been known for many years and occurs sporadically about every 4 to 5 years, but has increased in intensity significantly in recent years. This warming up destroys first the plankton and after that complete fish stocks...

Observing the creatures off our coast

This book, of course, makes no claim to complete scientific accuracy or a fact-oriented, all-encompassing truth. Rather, the author has attempted to assemble a picture from the very confusing puzzle pieces and fragments of shrimp trawler catches, his own observations and the messages of third parties. This picture is of course neither complete nor completely finished, because the puzzle pieces entrusted to the author are simply too few for this.

But even from the few pieces of the puzzle, valuable small pieces and aspects of a larger whole can already be recognized.

The author's horizon of observation extends, with interruptions, from the late 1970s and early 1980s until today.

Although these observations are largely based on a certain amount of subjectivity, they become more objective because it has been possible to shed some light on certain events through personal experiences and messages from third parties.

For example, some personal communications from the aquarium operators on the island of Borkum compensate somewhat for the "absences" of the author on this island, during which he could not be present there.

The author's collection, with which the discovery of certain animal species could be assigned to specific periods of time, also proved to be helpful in the creation of this work. Thus, for most of the hypotheses described here, there are real specimens that can be checked at any time. And so, in the meantime, about 500-600 jars with corresponding specimens have accumulated in the author's

cellar. It should also be noted that the animals preserved here were not collected and killed just for collection purposes, as most scientists would do.

But more than 95% of these specimens are animals that were either collected dead between garbage and by-catch, or that were later placed in an aquarium.

So there was no overexploitation of the endangered fauna of the North Sea, just to extend a collection. But even if we were to look closely at all these collection specimens, even these would only represent a very small part of the creatures that actually exist in the southern North Sea. Because it is estimated that in the whole North Sea there are at least 7000 different species of animals, of which about 4000 live in the German Wadden Sea. And there are probably even considerably more species if one were to take into account species introduced from other continents, and if one were to include the world of microscopic marine organisms, which is left out here in this work.

In order to draw conclusions about climate change from marine organisms, several aspects must be considered in context.

For example, it is a very important premise to first determine which species originally dominated the habitats of the southern North Sea. Then a careful comparison over time can be made and finally, in the final step, new species can be identified. The respective sizes of the specimens found and the new frequencies of these species play a very important role.

And if one looks at different groups of animals, a quite objective pattern emerges, which clearly shows the warming processes in the southern North Sea along the coast and off the East Frisian Islands.

Above all, it is a question of an overall trend that clearly shows that the deniers of anthropogenic climate change must either be completely blind or deaf. Or even suffer from the worst failures of human nature: namely, stupidity,

ignorance, consumerism, or selfishness. This book should help to show how far climate change has already come. And that it is by no means the crazy idea of left-wing eco-socialists or other environmental fanatics.

The truth can be denied, but its consequences will always catch up with its deniers and opponents. Some sooner, some later. In the end, the uncomfortable truth in this small tributary sea of the Atlantic will take its toll on all of us, whether we like it or not. The little colourful animals that have recently been romping in our waters should be better understood by us as a reminder from Mother Nature to all of our consumer behaviour. Because only if our philosophy of life and basic attitude change, we still have a future worth mentioning on this coast, which is still valuable for tourism...

The fate of our indigenous species

Autochthonous animal and plant species are generally defined as those species that have been known for long periods of time from specific localities. Basically the term autochthonous means as much as native or long-established. Not all autochthonous species are threatened by climate change, because there are actually some species that benefit from a warming up of the North Sea. The benefit then lies in opening up new ecological niches through the disappearance of other species, better reproductive opportunities or improved food supply. The latter could, for example, be the result of a more abundant growth of phytoplankton or other marine algae as a result of longer growth periods. Because the warmer the ocean is, the faster the tiny planktonic algae can multiply through cell division. However, there are (still) a number of animal species living in the German Bight which belong to the boreal or subarctic faunal group. And these will either migrate into deeper, colder areas on the sea floor or towards the north. At a certain point of no return, they will simply stay completely away from the shallow waters of the German Wadden Sea, especially the southern North Sea.

Now, this may not have too drastic an impact at first, if only a few subarctic species such as the great spider crab or the hooknose get lost from the ecosystem of the German Wadden Sea. Other species with a higher temperature tolerance will certainly move in from the south and try replace them. But in the medium and long term, such creeping changes could very well cause major and dramatic collapses, for example in fisheries or in the feeding of migratory birds. A lack of faunal components automatically

results in a different composition of the marine plankton, which could be decisive for the later number of useful fish in the sea and of nutrients for migratory birds in the tidal flats. This is because ecosystems are highly complex structures. The fate of herring and lobster is therefore already decided in the plankton, which can react very sensitively to changes in its environment, even at short notice...

A further problem of autochthonous species of the boreal climate zone is that they are adapted to very specific temperature ranges for the completion of their life cycles. In the North Sea, these are linked to specific localities, currents and seasons. If these parameters shift, the species affected may lose food sources or habitats. Or, in the worst case, the possibilities for reproduction of their species, which then leads to the extinction of the species. For example, some species are very dependent on certain sea temperatures, because oxygen levels and the thriving of broods depend on them. In March 2017, for example, there was a massive slump in smelt fishing in the Elbe estuary, and even in spring 2020 things looked bad for these once very common small coastal fish. In addition to the problem of water warming due to climate change, there was also sediment turbulence as a result of dredging and the extraction of cooling water for power plants, as well as the discharge of warm power plant waste water. It is also known from many fish species of the cold temperate faunal cycle that they require cold periods in winter to mature their gonads. If these are too short or do not take place at all, the species affected by them become infertile. In addition, the phenomenon that a warming up of the environment surrounding an organism accelerates its metabolism. This means that its metabolic processes now run faster and faster. The heart races, breathing becomes more hectic and the need for food increases rapidly. As a result, our autochthonous species can only adapt to an ever faster increasing climate change to a very limited extent, because

either they collapse themselves or they are no longer able to produce healthy and viable offspring. It is already a de facto situation, that commercial fishing fleets have to travel more than 100 kilometres further north than before, to be able to fish significant quantities of cod and saithe. As these have already begun to migrate towards Norway and Iceland.

In 2009, the cod stocks in the North- and Baltic Sea had already collapsed.

And the same happened in 2009 in the southern North Sea with flatfish. At present (2020), plaice and sole are considered to be rather scarce in the southern North Sea...

Invertebrates & Algae in the context of climatically changes

Since its foundation in 1892, the Biological Institute on Heligoland has been measuring and documenting the water temperatures in the North Sea at different times of the year, from which an annual average value has always been obtained. The result of these measurements is clear: since the last 50 years alone, the North Sea has warmed up by about 1.7° Celsius. And since the beginning of these measurements more than 100 years ago, this value has probably even risen by 2° - 3° Celsius. Now one could argue that this is only a very small rise in temperature, hardly perceptible for a person bathing. But:

The world ocean is on average only about 3.8° Celsius warm anyway, if you include the water masses of the deep-sea trenches and the Arctic and Antarctic regions. If one were to relate these values, i.e. 3.8° world ocean average and 1.7° North Sea warming by simple rule of three calculation, the North Sea would have warmed up by 44.73% in the last 50 years compared to the entire world ocean. If we disregard this approach and only put the warming of the North Sea from a temperature of about 9.5° Celsius in 1965 in relation to a temperature increase of 1.7° by the year 2015, then the North Sea has still warmed up by almost 18% in only 50 years! The rise in temperature in the North Sea (the German Bight) is thus an officially proven fact and seems to be developing disproportionately to the other global warming, as this was only about 1° Celsius in the same period. This is mainly due to the fact that the North Sea as a whole is a relatively shallow shelf sea with an average depth of only about 70 metres, which in addition

has only one deep basin in the north, the Norwegian basin, which is about 700 metres deep. In addition, there are also very extensive waddens, which regularly dry out very extensively due to the tidal range and heat up particularly strongly in summer thanks to the sunlight on these dark areas.

Thus, the animals and plants of this tidal habitat have to cope with various extreme life situations. In winter with icy cold, but in summer with constantly increasing subtropical and tropical temperatures. In some cases they adapt to these changes at short notice, in other cases they migrate or simply die out. An example of a temporary adaptation to higher sea temperatures is the large brown seaweed on the island Heligoland, which, according to the observations of marine biologists, has started to anchor its rhizomes at ever greater depths on the rocks in front of the island. They do this not, because they have developed a lower demand for sunlight, but rather, because the surface water has simply become "too warm" for them in the summer months. Seaweeds react very sensitively to warmer water, which you can test for yourself in a cooled marine aquarium. If the water becomes too warm - and if it is even a single degree Celsius higher - the kelp may suddenly become slimy and dissolve. Some seaweeds then release gametes through this self-abandonment, through which they reproduce in order to at least ensure the survival of the species elsewhere. In nature a sensible adaptation to changing living conditions - in the aquarium usually a catastrophe for all other inhabitants of the tank, who can be downright poisoned by this. But also in nature a mass death of algae or seaweeds can lead locally to a mass death of fish and other marine animals. Especially in shallow sea bays and waddens, which can be covered by algae in a short time. This may then be accompanied by the development of harmful bacteria and viruses, which not only cause "red tides" and fish mortality,

but can also become dangerous to humans themselves. Like the thermophilic vibrios.

These germs can even enter the human organism through small open wounds, where they can cause severe diseases, especially to immunocompromised persons, such as sepsis and in consequence sometimes even death! Probably the best known of these pathogens is the **Cholera bacterium *Vibrio cholerae***, which causes cholera. The **Wound bacterium *Vibrio vulnificus*** occasionally makes headlines by causing cellulite and sepsis in immunocompromised persons, especially in the shore zone of the Baltic Sea during the summer heat, sometimes with a life-threatening course.

So a sea warming up in summer in shallow water is anything but a harmless natural phenomenon! In the following chapters we will look at some very different groups of invertebrates which have now more or less become native to the southern North Sea off the East Frisian Islands. Some of them used to be "seasonal animals", which could be found sporadically only for a few days or weeks in the German Bight. But today they have become part of the "permanent population" of this area. Two things prove this: First the establishment of local populations, which suddenly appear regularly in certain areas. And second the presence of their juveniles. Which suggests, that they not only spend the winter here, but can also reproduce. So what was the rare exception in 1960 is now beginning to become the rule. This would not change much even if we were to have an extremely cold winter with arctic temperatures in 2020. It is true that the northernmost populations of immigrants would then die off in the short term. But because of the overall warm trend of the last decades, they would be back by the next warm summer at the latest and would start their populations again. However, there are several different types of immigrants, because not all species are here because of the warmer climate. Some simply came from

overseas as larvae in the ballast water of ships into our waters, and can establish themselves here because of similar living conditions. Others are part of the typical English Channel fauna, that can be found on the French and British coasts.

These species are not without problems in that they can either displace our native species or even mate with them, thereby destroying their genetic potential. So it is very worrying when we recently see specimens of species that have the characteristics of various related species that are difficult to identify. These phenomena can now be regularly observed in blue mussels of the genus ***Mytilus*** and shore crabs of the genus ***Carcinus***. And then there are the species introduced by aquacultures, such as the **Pacific Giant Oyster *Magallana gigas***, which benefit greatly from the warming up of the oceans due to their warm regions of origin in Asia. And some species have been found as single specimens, which can be regarded as vanguard for further biological input into the German Wadden Sea. I found many of these species on plastic garbage and other human relics that our shrimp fishermen had collected with their nets from the tidal flats of our German coasts. However, it is very pointless to discuss whether these garbage finds were transported from the coasts of the English Channel by the flow to the German coasts, or whether these organisms entered our waters as larvae and only then colonized the garbage. Fact is, that they suddenly appeared out of nowhere.

And at least nobody had really noticed them before. In January 2020 alone, I found three(!) new species from the English Channel on a single plastic box, which could be determined quite well with the help of a Kosmos-nature book and a subsequent Internet comparison. In the following, I will go into more detail about various invertebrates, whereby I was able to relate their appearance to a certain extent to current environmental events.

Phylum *Mollusca* - Molluscs

In the North Sea you will unfortunately not find as many species of molluscs as in the tropics, because the biological diversity is lower. But there are always representatives of the Arctic faunal circle, such as the Icelandic clam, which in the deeper areas of the southern North Sea meet with immigrant species from the English Channel. Such as the common otter mussel. In the past, one faunal circle dominated slightly, then the other again. Today the Arctic faunal circle withdraws to the north, so that the Icelandic clam, for example, may soon have completely disappeared from the southern North Sea. This is because species of the Arctic faunal circle can only escape the heat to the deep or to the north. Such species then die out unnoticed at first.

This means that serious conclusions must be drawn from the loss of species.

No statement at all - i.e. no finding - is sometimes also a statement! In addition, the size of specimens of new species found is also important, as these can provide information about the food supply and the altered growth intervals. Especially in the case of bivalve molluscs, heat and cold phases can be read off excellently from the formed annual rings of their shells. By the way, this also allows to determine the year in which a mussel was formed and how old it actually became. This type of observation then enables the experts to draw precise conclusions about the climate development.

Slipper-Limpet*, Crepidula fornicata* (Linnaeus, 1758)

The **Slipper Limpet** does not belong to the endemic snails of the North Sea, as it was introduced by ships only a few decades ago. Slipper snails owe their name to the oval shape of their shell, which again contains a white inner pocket made of lime, behind which the mollusc attaches itself to its shell.

Thus the empty shell of this snail is indeed reminiscent of a slipper with a cavity for the foot. Inside, the shell shines red-brownish pearly. Slipper snails live as filter-feeders, whereby they filter the finest particles out of seawater and then use them as food. But they also seem to be able to graze algae films off their substrate when necessary. However, slipper snails very rarely move on their substrate. They are also not able to turn around on their own when they are torn off the substrate. Therefore they suck themselves very firmly on their respective substrate and can only be torn off with brute force. Mostly they cling to stones, wooden posts or other shells. Slipper snails are hermaphrodites, which change their sex in the course of their life.

That is why they often sit on top of each other, so that they can release their different sexual products into the water at the same time. In appropriate aquaria without significant predators, slipper snails can survive up to one year, but unfortunately, they usually starve to death due to a lack of suitable fine food. Recently some specimens could be found in plastic waste and old boxes, which had developed unusual shell shapes. Some of them were very flat and because of this shape reminded more of the slipper

snail of the Mediterranean Sea. However, on the coasts of North and Central America there are also some species with a very flat shell, such as the species ***Crepidula excavata***, for example. Another specimen even had a strangely wavy shell and showed similarities with several other species of the American faunal circle. It is also conceivable, that these are only newly formed morphs of ***Crepidula fornicata***, which have now adapted to a warmer and dirtier environment...

Slipper snails often sit on top of each other for synchronous spawning.