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Pokémollusca: the mollusk-inspired Pokémon

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The phylum Mollusca appeared during the Cambrian Period, over 500 million years ago, alongside most other animal groups (including the Chordata, the group we belong to). There are even some older fossils that could be mollusks, although their identity is still hotly debated among scientists.

Mollusks are a very biodiverse group. We do not yet know the precise number of species, since many are still unknown and being described every year. However, estimates go from 70,000 to 200,000 (Rosenberg, 2014). And that's just for the living species. As such, mollusks have long been considered the second most diverse group of animals – the first place belongs to arthropods.

Mollusks can be found in almost all sorts of habitats: land, freshwater and marine, including the deep sea and hot vents. The only thing they can't do is fly.

They are also a very unique group in terms of body shapes (morphology), including extremely disparate forms: snails, slugs, clams, mussels, squids, octopuses, nautiluses, chitons, tusk shells, and the odd worm-like aplacophorans. And there were other forms yet, which are now extinct: ammonoids, belemnites and rudists. Mollusks go from tiny snails less than a millimeter long to giant squids, almost 20 meters long and the largest known invertebrates.

The main groups of mollusks, however, are just three: Gastropoda, or gastropods, which include snails and slugs; Cephalopoda, or cephalopods, which include squids and octopuses; and Bivalvia, or bivalves, which include mussels and clams.

Curious creatures that they are, mollusks make nice "monsters" and are constantly being featured in video games (Cavallari, 2015; Salvador & Cunha, 2016; Salvador, 2017). One very famous game that features mollusks is *Pokémon*, a franchise that started with two games released by Nintendo for the Game Boy in 1996. More than 20 years later, the series is still strong, currently on the so-called seventh generation of core games, but counting with several other video games, an animated series, films, a card game, and tons of merchandise. Also, there's an eight generation of games on the horizon.

Most monsters in *Pokémon* are based on real animals (see, for instance, Tomotani, 2014; Mendes et al., 2017; Kittel, 2018), so the goal of this article is to present those based on mollusks. Some of them were just broadly based on a larger group of mollusks, such as 'octopuses', while others seem to have been inspired by particular species. Thus, we indicate the real species or group that served as inspiration for the monsters and explain a little bit about their biology. Whenever possible, we outline specific features of the real animals that were transported to the games (such as types, moves, abilities, etc.).

LIST OF MOLLUSK POKÉMON

We analyze each mollusk Pokémon below; they are listed in the same order as in

the National Pokédex (this number is given with a "#" on each entry). All the illustrations of the Pokémon reproduced here are the official art by Ken Sugimori and were extracted from *Bulbapedia* (https://bulbapedia.bulbagarden.net/). Likewise, all information on the Pokémon (size, weight, and description of abilities and moves) were taken from their entries in *Bulbapedia*, considering only the game's current generation (Gen VII).

The systematic classification of the mollusks used here follows Bouchet et al. (2010, 2017) and WoRMS (World Register of Marine Species). Images of real mollusks were extracted from Wikimedia Commons, except where otherwise noted; credits are given in each figure's caption.

Shellder
(#090; Type: Water)

Class: Bivalvia (bivalves)

Order: Pectinida (scallops and oysters)

Family: Pectinidae (scallops)

With its googly eyes and what seems to be a hanging tongue, Shellder looks somewhat scared or mesmerized (or perhaps both). This small shell-bearing fellow is surely designed after a bivalve mollusk. And, curiously enough, the large eyes are actually not out of character: even though most bivalves have no eyes, the Pectinida, a.k.a. the scallops and their allies, are an amazing exception. These animals are found in all of the planet's oceans and the family Pectinidae is in fact one of the largest marine bivalve families, including over 300 living species belonging to 60 genera (Waller, 2006). They do have incredible eyes with a very intricate structure that allows them to measure amounts and intensity of light coming from different directions (Morton, 2008). As far as we know, scallops can discriminate light from dark, spot surrounding algae, and perceive moving objects or obstacles (and react accordingly). Judging by its real-world counterparts, Shellder shouldn't necessarily have a hard time aiming its "Clamp" or "Razor Shell" attacks, hiding from someone else's attacks, or swimming away from menacing foes. And yes, scallops also have awesome swimming abilities, which are also not common among bivalves in general. Most bivalves are very good swimmers during their early days as planktonic larvae (known as veligers), but become sessile when adults, spending their lives burrowed in the sand or attached to a rock or other hard surface.

Top: Scallops on the seabed (CSIRO, 2001). Bottom: Close-up of the blue eyes (M. Krummins, 2014).

As for the shell itself, Shellder seems to belong to the family Pectinidae because of its overall shape. Even so, Shellder's tongue, in particular, is a very interesting topic. It looks very similar to a bivalve's foot, a bulky, muscular structure that allows it to burrow itself into the sand, among other things. However, though the foot is

very conspicuous in most bivalve lineages, it is reduced in pectinids (Shumway & Parsons, 2011). At the same time, though they are never protruded, some of the animal's organs such as the gonads are often visible from the outside in real world bivalves, and they can resemble a tongue hanging between open lips. We do, however, prefer to think of Shellder's tongue as a foot for obvious reasons. Pectinids usually don't grow up to the huge proportions of 0.3 m and 4 kg informed by the Pokédex, but other real-world clams can become even larger (see Cloyster below).

Cloyster
(#091; Type: Water / Ice)

Class: Bivalvia (bivalves)

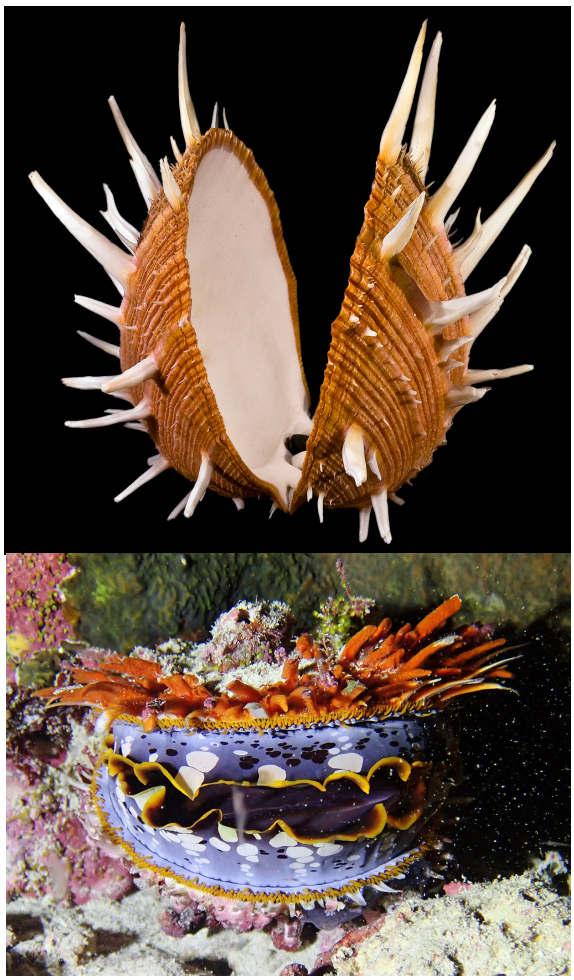
Order: Pectinida (scallops and oysters)

Family: Spondylidae (thorny oysters)

Genus: *Spondylus* Linnaeus, 1758

A rather fierce-looking version of its pre-evolved state, Cloyster sports a larger, thicker and rougher shell, complete with spikes/thorns, which are typical features of the bivalve family Spondylidae. Commonly known as thorny or spiky oysters (they are not part of the so-called "true oysters", which belong to the family Ostreidae), spondylids are close relatives of the common scallops (Matsumoto & Hayami, 2000). Among many other striking morphological characters, such as their many eyes spread along the animal's mantle, pectinids and spondylids share an overall similar shell outline but the latter are usually bulkier and spikier.

As for being bulkier, Cloyster is many times larger and heavier than Shellder, spanning up to 1.5 m wide and weighing over 130 kg, a size unattainable for any real-world spondylid, but still not entirely fictional: some bivalves in the family Tridacnidae (a.k.a. giant clams) can weight over 200 kg (Knop, 1996). Nevertheless, even though spondylids certainly do not grow to such humongous proportions, the increased size and the prominent, more numerous spikes make up for a more menacing and stronger version of the childly-looking Shellder, with a malicious look as a bonus.



Top: *Spondylus regius* Linnaeus, 1758 (D. Descouens, 2009). Bottom: *Spondylus* sp. (F. Ducarme, 2018).

The attacks are all very similar to Shellder's, with the addition of a "Spike Cannon" move (yet another reference to the thorny Spondylus shells). Likewise, if Shellder is based on pectinids and Cloyster on spondylids, the "close" relationship between the two Pokémon thus elegantly (though hardly intentionally) reflects their real-world

kinship.

Of course, spondylids are not the only spiky bivalves out there. The Japanese spiky oyster, *Saccostraea kegaki* Torigo & Inaba, 1981 (family Ostreidae), for example, also has a spiky shell that seems quite uninviting to the touch. But spikes aside, it lacks some other traits observable in Cloyster that indicates it was probably inspired by real-world spondylids, *e.g.*, the bulkier shell. Besides, true oysters have very variable shape, not very similar to Cloyster's symmetrical, scallop-like profile. Its shell also includes wing-like or ear-like projections located at the rear (called auricles), which also appear in some spondylid species (Shumway & Parsons, 2011).

Omanyte
(#138; Type: Rock / Water)

Class: Cephalopoda (squid, octopuses and nautiluses)

Subclass: Ammonoidea (ammonoids)

Omanyte and its evolved form, Omastar (see below), are based on a generalized ammonoid. Ammonoids[1] are cephalopod mollusks who once crowded the seas, with an astounding diversity of species. Unfortunately, they went extinct together with non-avian dinosaurs during the great extinction event in the end of the Cretaceous period. True to its roots, Omanyte is not found alive in the game: it is found as a fossil (called "Helix Fossil") on a rocky matrix. The player must then "resurrect" it in a very Jurassic Park manner. As all fossils in the *Pokémon* franchise, Omanyte and Omastar are Rock-type. On a side note, the Helix Fossil recently spun its own mythology on *Twitch Plays Pokémon*, where it acted as a sort of oracle to the players (for the whole story, see Salvador, 2014).

Despite being very similar to a real ammonoid fossil, Omanyte bears a huge flaw in its design. The soft body is positioned in an inverted manner in relation to the shell. That is, Omanyte's body is positioned like the body of a snail (a gastropod), rather than like the body of a cephalopod (Salvador, 2014). Omanyte is depicted with 10 arms, but the real numbers an ammonoid would actually have is unknown because other living cephalopods have a variable number (Monks & Palmer, 2002): nautiluses have 50 to 90 arms, squids and cuttlefish have 10 (two of which are called tentacles) and octopuses have 8.

Top: *Asteroceras* sp. (Daderot, 2012). Bottom: Reconstruction of *Asteroceras* sp. (N. Tamura, 2009).

Omanyte can have the ability called "Shell Armor" (see above), which makes

[1] In common parlance, they are knows as "ammonites", but from a more strict scientific perspective, ammonites (order Ammonitida) is a smaller group inside the ammonoids (subclass Ammonoidea).

sense, and can learn the move "Withdraw". Although no living ammonoid exists, they were thought to be able to withdraw into their shells for protection like their present-day "cousins", the nautiluses (Monks & Palmer, 2002). It can also learn the move "Shell Smash", which does not make sense: why would a mollusk break its only means of protection?

Omastar
(#139; Type: Rock / Water)

Class: Cephalopoda (squids, octopuses and nautiluses)

Subclass: Ammonoidea (ammonoids)

Omastar is very similar in design to Omanyte (even retaining the gastropod-like position of the body), with a few important differences. (1) Beak: Omastar has a tetrapartite beak. Living cephalopods have a parrot-like beak made up of two interlocking jaws, and ammonoids thus probably also had a beak (Engeser, 1996; Monks & Palmer, 2002). We say "probably", because features of the soft body hardly ever are preserved in the fossil record. In any case, a beak made up of four parts such as Omastar's is a bit of an overkill.

(2) Spikes: Omastar's shell is lined with spikes. It can learn the move "Spike Cannon", which means it supposedly can shoot them as projectiles. Needless to say, ammonoids species that were ornamented with spikes (for instance, *Apoderoceras* spp. and *Euhoplites* spp.) would not be able to do that. Even so, the function of shell spikes in ammonoids is thought to be defensive, to discourage potential predators of taking a bite (Ward, 1981; Monks & Palmer, 2002).

(3) Size: while Omanyte measures 0.4 m and weighs 7.5 kg, Omastar reaches 100 cm and 35 kg. Of course, every player worth their salt knows that these Pokédex entries are just plain crazy, but it can serve here to illustrate how awesome ammonoids were. A 1 m high Omastar might seem too large to be possible, but one ammonoid species could reach up to 2 m in shell diameter (estimated 2.5 m or even 3.5 m if the largest known fossil was complete; Teichert & Kummel, 1960). This species is called *Parapuzosia seppenradensis* (Landois, 1895) and is known from the Cretaceous Period of Germany. Its shell is estimated to have weighed circa 750 kg in life and this value would increase to 1,400 kg with the animal's soft body (Teichert & Kummel, 1960).

Euhoplites armatus Spath, 1928 (courtesy J.-S. David; www.jsdammonites.fr).

Curiously, *Bulbapedia* states that the shell of Omastar was too heavy to move and this led to the species extinction (they died out from starvation). This type of view about extinction, which supposes that the animals were somehow inept and unable to survive, is completely outdated – not to say completely ridiculous. The same story was told

long ago about the extinction of the "slumbering dinosaurs", but this is now known to be false. Extinction can have many causes, including environmental changes, competition with other species, predation, calamitous events, and, of course, irresponsible humans.

Slugma
(#218; Type: Fire)

Class: Gastropoda (snails and slugs)

Superorder: Eupulmonata (pulmonate snails and slugs)

Order: Stylommatophora (terrestrial snails and slugs)

Slugma was clearly based on slugs, but not on any particular species: rather, its design is broadly generalized. The superorder Eupulmonata (earlier known as order Pulmonata) within the gastropods contain the highest diversity of terrestrial forms (over 20,000 species of land snails and slugs; Rosenberg, 2014). The "slug" body shape is a modification of the typical snail body in which the members of the lineage go through shell reduction, shell internalization (it becomes a small piece within the animal's body) and sometimes the complete loss of the shell (Barker, 2001). This process, called "limacization" (or "transformation-into-a-slug"), happened separately several times within Eupulmonata, in many distinct families (Veronicellidae, Rathouisiidae, Arionidae, Limacidae, etc.). Is it though that losing its shell increases the mobility of the animal and capacity to explore and hide in smaller spaces (Cameron, 2016). However, the absence of the shell means that the animal is more vulnerable to predators and to the worst enemy of terrestrial gastropods: evaporation.

Terrestrial gastropods have soft moist bodies and are constantly losing water to the environment by evaporation. A very large portion of these animals' evolutionary history is related to mechanisms and strategies to decrease or avoid losing precious water (Barker, 2001). Also, slugs cannot be too large, because of water loss and the lack of a skeletal structure to sustain the body. Of course, the 0.7 m tall Slugma is basically a *Dungeons & Dragons* fire elemental, so water loss is not even in question.

Top: *Arion rufus* (Linnaeus, 1758) (H. Hillewaert, 2008). Bottom: *Limax* cf. *dacampi* Menegazzi, 1854 (Hectonichus, 2005).

Slugs are worm-like creatures that craw horizontally, but Slugma has a somewhat upright posture, with its head permanently reared up. Although slugs can sometimes strike such a pose (when trying to climb something, for instance), they do not spend their whole time nor do they move around like this.

Magcargo
(#219; Type: Fire / Rock)

Class: Gastropoda (snails and slugs)

Superorder: Eupulmonata (pulmonate snails and slugs)

Order: Stylommatophora (terrestrial snails and slugs)

The evolved form of the slug Pokémon Slugma is Magcargo, a snail. As explained above, biological evolution has always worked the other way around, with slug species arising within snail lineages. In any event, it is evident that "evolution" in Pokémon has absolutely nothing to do with biological reality – and we hope we do not need to explain here that it is impossible for an animal to transform into another after it has gained enough XP. That'd be cool, though.

Like Slugma, Magcargo has a generalized design but this time around, based on a snail. In fact, its name is a combination of the words magma and escargot (French for snail). Curiously, Magcargo has a planispiral shell, meaning that its shell is coiled on a single plane, resulting in a flat appearance. Planispiral shells are very rare in land snails, presumably because carrying a shell shaped like this on land is rather clumsy. However, planispiral shells are very common in freshwater snails, where the water helps to sustain it; there is a whole family with planispiral shells, aptly named Planorbidae (from the Superorder Hygrophila, the sister-group of Eupulmonata). Typically, the shells of land snails are more globose or more elongated. In any event, land snails carry their shell a little tilted to the side, not upright as Magcargo.

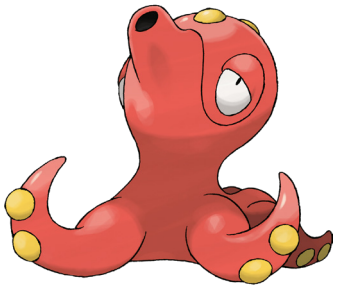
Top: *Planorbarius corneus* (Linnaeus, 1758) (C. Ableiter, 2007); Mid: *Cepaea nemoralis* (Linnaeus, 1758) (D.G.E. Robertson, 2008); Bottom: *Drymaues papyraceus* (Mawe, 1823) (courtesy of L. Charles).

Magcargo is huge for a snail, measuring 0.8 m in height and weighing 55 kg. As explained above for Slugma, this size would pose problems regarding water loss, but a more pressing issue is body weight: a snail cannot sustain such a heavy body on land, nor hold up and carry around a rock-like

shell. The largest land snail species is the fossil *Pebasiconcha immanis* Wesselingh & Gittenberger, 1999 (from the Miocene of Colombia and Peru), but its shell is "lightweight" in comparison to Magcargo, reaching up to "meager" 26 cm in length (Wesselingh & Gittenberger, 1999).

Bulbapedia states that Magcargo could be based on the Cherufe, a volcano-dwelling creature from Argentinean and Chilean folklore. However, this is extremely unlikely for two reasons: (1) Cherufe is typically a gigantic humanoid monster, albeit with some dragon-like features such as a predilection for meals including young girls (Lurker, 1987; Rose, 2001), with no mention of molluscan features. (2) More to the point, the people responsible for *Pokémon* only rarely look outside of Japan (or Japanese zoos) for influences; for instance, even Generation VI, which is supposedly based on France, has a very Japanese fauna (Tomotani, 2014).

Octillery
(#224; Type: Water)



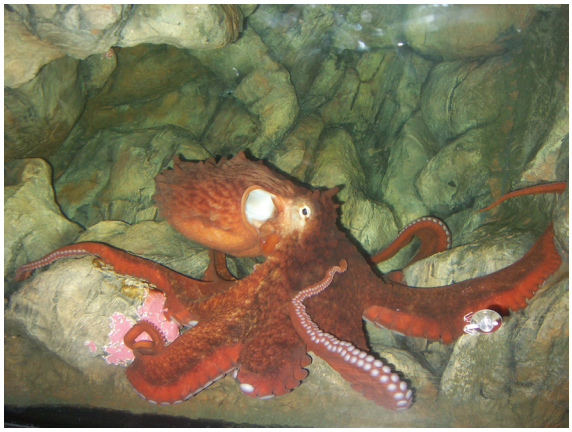
Class: Cephalopoda (squids, octopuses and nautiluses)

Subclass: Coleoidea (octopuses, squids, and cuttlefish)

Order: Octopoda (octopuses)

Octillery has a generalized cartoon-octopus look and, thus, not much can be said about its morphology. However, there is one feature that is clearly mistaken (as in numerous other cases in Japanese games and anime/manga): the structure that is depicted as Octillery's mouth is actually the funnel. To breathe, cephalopods bring water into a chamber inside their body called the "mantle cavity", where the gills are located. Then, the water is expelled through the funnel; this can be done quietly or in a more powerful gush of water, enabling the animals to move by jet propulsion. The mouth of a cephalopod is located where all the arms meet, facing "downwards" and hidden from view, and the funnel is located laterally (not in front, like in Octillery).

While most octopuses are not very large, Octillery can reach a respectable size: 0.9 m high, weighing 28 kg, according to its Pokédex entry. The largest octopus alive is the giant Pacific octopus, *Enteroctopus dofleini* (Wülker, 1910). Large adults can reach 6 m in radial "arm span" and weigh about 50 kg, but some records increase the span to somewhere between 9 and 10 m (High, 1976; Hartis, 2011).



Enteroctopus dofleini (Wülker, 1910) (Bachrach44, 2008).

One of Octillery's in-game abilities is called "Suction Cups"; its description says: "This Pokémon uses suction cups to stay in one spot to negate all moves and items that force switching out." This is a very pertinent ability, as the arms of octopuses (and squids and cuttlefish) are covered with suction cups (also called "suckers") on their inner surface. These suction cups are used in locomotion and to manipulate objects and prey. The cups are astonishingly strong, and the animals can control each of them independently.

Octillery's signature move is called "Octazooka", the description of which says:

"The user attacks by spraying ink at the target's face or eyes. This may also lower the target's accuracy." This is likewise a very pertinent move, as cephalopods are famous for their ability to squirt dark ink. These animals have an organ called "ink sac" and can expel the ink lodged inside it – through the funnel – as a dark smoke-screen-like cloud. When cephalopods are attacked, this strategy confuses the predator and allows them to escape (Sato et al., 2016). Moreover, recent studies suggest that ink clouds may also be used to confuse prey, allowing a sneak attack bonus (Sato et al., 2016).

As a last note, Octillery is the evolution of Remoraid, which is a remora, a type of fish (Mendes et al., 2017). Again, we know that "evolution" in Pokémon bears no resemblance to biological reality, but this might be taking the craziness a tad bit too far.[2]

Clamperl
(#366; Type: Water)

Class: Bivalvia (bivalves)

Order: Heterodonta

Family: Tridacnidae (giant clams)

Genus: *Tridacna* Bruguière, 1797

Species: *Tridacna gigas* (Linnaeus, 1758) + fish egg of an unknown species

Appearances can often be deceiving in the *Pokémon* world. Though Clamperl may look like and is certainly named after a mollusk, the pinkish "pearl" inside its shell is actually a fish egg – or rather, roe. Roes are egg masses of fish and certain marine animals, such as urchins, shrimp, and even scallops. Even though some mollusks produce eggs, both of Clamperl's evolved forms, Huntail and Gorebyss, are actually fish-like Pokémon (Mendes et al., 2017), which clarifies its true nature . This pink egg rests on what seems to be a soft, bluish pillow with stubby projections. It is as if a random giant clam is offering its body as protection for the fish egg – and so, Clamperl is actually composed of two different organisms in association – or symbiosis, if you may. In fact, this is not unheard of in the *Pokémon* franchise, and some cases also involve mollusk-inspired Pokémon (we're looking at you, Slowbro and Slowking).

Nevertheless, its shell seems to be based on real-world giant clams, a.k.a. bivalves in the family Tridacnidae and genus *Tridacna*. Its overall size and weight (0.4 m and 52 kg) are also not out of this world: as we mentioned before, species such as *Tridacna gigas* (Linnaeus, 1758) are huge and can measure as much as 137 cm and weight 230 kg (Knop, 1996). Clamperl's abilities and attacks also refer to and reinforce the relevance of its shell: Shell Armor, Shell Smash, and, of course, the signature attack Clamp.

Tridacna gigas (Linnaeus, 1758) (Liné1, 2008).

Curiously, getting a leg or arm clamped by a giant clam is actually the stuff of legend: giant clams were called "killer clams" and "man-eating clams" in the past due to having allegedly drowned divers that got stuck between their valves (each individual piece of a bivalve shell is a valve).

[2] Recently, some of the preliminary sprites for Gen II were found by dataminers (https://mobilesyrup.com/2018/05/31/unreleased-pokemon-sprites-gold-silver/), showing that proto-Remoraid was a gun-shaped Pokémon and proto-Octillery was a tank-shaped Pokémon. We had a really hard time deciding which option makes less sense and ended up abandoning this question.

This rumor probably originated in Wilburn Dowell Cobb's romanticized article on the discovery of the "Pearl of Allah" (or Pearl of Lao Tzu) published on the Natural History magazine in 1939. One of the largest pearls ever found, with 24 cm in length and weighing ca. 6.4 kg, it was retrieved from a giant clam that, according to Cobb's (1939) dramatic description, ended up "slaying a native diver trapped when its great jaws snapped shut". And by jaws, he probably meant the valves. Cobb went as far as calling the clam a "deep sea murderer".

Both things are strictly wrong: giant clams are not a deep-sea species, nor murderers of any kind: they have a symbiotic relationship with algae, which use sunlight (not present in the deep sea) to synthesize their food supply. Influenced by such dramatic descriptions, even scientific and technical manuals once claimed that clams had caused deaths, and even gave instructions on how to release yourself if you were stuck. Nowadays, we know this reputation is rather underserved: not a single human death by giant clam has ever been reported (scientifically, that is). Moreover, the adductor muscles in giant clams, which are responsible for closing their shells, move rather slowly (Fredericks, 2014). Hence real-world clams are, in fact, quite gentle giants.

Shellos
(#422: Type: Water)

Class: Gastropoda (snails and slugs)

Order: Nudibranchia (sea slugs)

Family: Chromodorididae

Genus: *Chromodoris* Alder & Hancock, 1855 and *Hypselodoris* Stimpson, 1855

Top: *Chromodoris lochi* Rudman, 1982 (A.R. Jenner, 2009). Bottom: *Hypselodoris apolegma* (Yonow, 2001) (C. Ordelheide 2011).

Nudibranchia is a peculiar group within the Opisthobranchia, a.k.a. the sea slugs. Well-known because of their vivid colors and extravagant forms, nudibranchs (or nudis, if you wish) are among the most beautiful and popular sea creatures out there. They live pretty much everywhere, inhabiting the seas worldwide from arctic to temperate and tropical regions (but unlike Shellos, definitely not on land). Shellos's design seems to be clearly based on nudis – it has a long and somewhat flat, colorful body, with flappy lateral expansions, and the head appendages are very similar to rhinophores, which are characteristic sensory structures of nudibranchs. The color patterns are very similar to nudibranchs belonging to the family Chromodorididae found in Japan such as *Chromodoris lochi* Rudman, 1982, *Hypselodoris festiva* (A. Adams, 1861), and *Hypselodoris apolegma* (Yonow, 2001). Moreover, Shellos's proportions (0.3 m and 6.4 kg) are actually not exaggerated: nudibranch spe-

cies such as *Hexabranchus sanguineus* (Ruppell & Leuckart, 1828) can grow as long as 52 cm (Double, 1992).

Remarkably, Shellos was one of the first attempts of the franchise at introducing the concept of regional variants back in Pokémon Diamond and Pearl (Gen IV) in 2006–2007. This would become a central theme in Pokémon Sun and Moon (Gen VII), ten years later. Nevertheless, back then, Shellos presented two forms corresponding to two distinct regions: the blue form inhabits the East Sea, and its pink "cousin" lives in the West Sea. This is clearly a nod to the phenomenon of geographic (a.k.a. allopatric) speciation: it happens when populations of the same species become isolated due to geographical barriers, forming two or more new populations that evolve independently in different forms.

One curious thing about Shellos (and its evolution Gastrodon, see below) is the fact that it can learn some pretty nasty poison abilities, even though it is not a Poison-type Pokémon. In the real world, some nudibranchs store toxins and other unpleasant or harmful substances/structures they get from other organisms they feed on such as algae, anemones, and coral. They effectively use these substances as a defense mechanism. Sometimes, their striking colors, which may be especially vivid in the parts of the body where the harmful substances are stored, serve as a warning for visually oriented predators: a phenomenon known as aposematism (Aguado & Marin, 2007). As pretty as Shellos may look, its bright colors could signal danger.

Gastrodon
(#423; Type: Water / Ground)

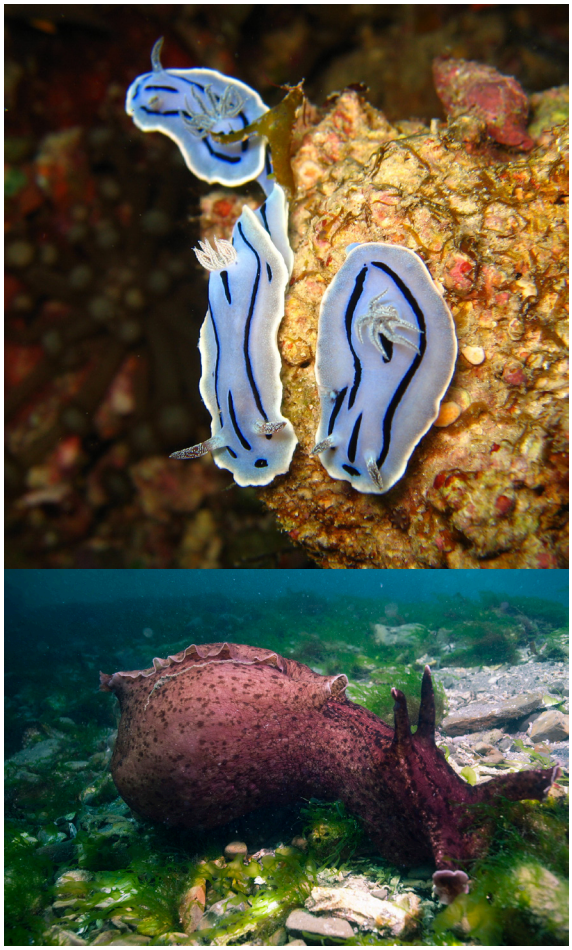
Class: Gastropoda (snails and slugs)

Order: Nudibranchia (sea slugs)

Family: Chromodorididae

Genus: *Chromodoris* Alder & Hancock, 1855 and *Hypselodoris* Stimpson, 1855 (and maybe *Aplysia* Linnaeus, 1767)

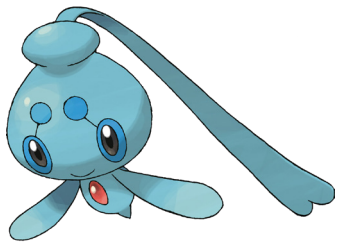
Much like its pre-evolution Shellos, Gastrodon's design is largely based on nudibranchs or other related marine slugs. Our considerations about Shellos also apply to Gastrodon, with a few exceptions. Gastrodon is quite larger than Shellos, measuring as long as 90 cm and weighing up to 30 kg. This is way too large for real-world nudibranchs, but not entirely disproportionate: a species of sea hare, *Aplysia vaccaria* Winkler, 1955 can measure up to 99 cm long and attain a total weight of 14 kg (Behrens, 1992).



Top: *Chromodoris willani* Rudman, 1982 (J. Tanaka, 2006). Bottom: *Aplysia californica* (Cooper, 1863)(C. King, 2011).

In fact, *Bulbapedia* claims the East Sea variant of Gastrodon was designed after sea hares. Nevertheless, sea hares are not nudibranchs but belong to a group called Anaspidea, one of the many lineages within the Heterobranchia, a natural group of gastropods that also includes Nudibranchia. You could think of them as distantly related "cousins". In any event, the design of East Sea Gastrodon is only remotely alike sea hares and much more closely resembles chromodoridid nudibranchs, being very similar to the species *Chromodoris willani* Rudman, 1982, from the Western Pacific.

Phione
(#489; Type: Water)



Class: Gastropoda (snails and slugs)

Order: Pteropoda (sea butterflies)

Suborder: Gymnosomata (sea angels)

Family: Clionidae

Genus: *Clione* Pallas, 1774

Species: *Clione limacina* (Phipps, 1774)

The so-called sea angels are actually free swimming (pelagic) sea slugs scientist collectively call Gymnosomata (from the Greek, meaning "naked body", a direct reference to their shell-less bodies). They belong to a group called Pteropoda, the sea butterflies, which means "wing-foot". Pteropods use their wing-like flaps, known as parapodia, to swim about searching for prey. Yes, prey: they are voracious predators of planktonic invertebrates, including other pteropods (Hermans & Satterlie, 1992). While most pteropods have shells, the lineage of the Gymnosomata lost it during its evolution.

Elegant and somehow intimidating (if you're just small enough), sea angels in the genus *Clione*, especially *Clione limacina* found in Hokkaido, are quite popular in Japan (Hutcheon, 2010). The in-game region Sinnoh is reportedly based on Hokkaido, which makes *Clione limacina* the obvious inspiration for Phione. Even their names are almost the same.

Clione limacina (Phipps, 1774) (NOAA, 2005).

It is no surprise that Phione, the single mythical[3] molluscan Pokémon alongside Manaphy, was based on sea angels, whose name is already kind of mythical. Measuring 40 cm long (weight ~4 kg) according to the Pokédex, it is a little too large for a sea angel: they never grow past a few centimeters. However, even though it is somewhat stylized, Phione's (as much as Manaphy's) appearance is that of a sea angel with the signature wing-like parapodia, a well-marked head, and tail-like body. We can see some attention to detail has been paid, as the red gem on Phione's "chest" resembles

[3] The mythical status of Phione is highly debated within the community – yes, those are debates that actually happen – since official sources are ambiguous and contradictory (see *Bulbapedia* for more info). Manaphy, on the other hand (or should we say foot?), is indeed mythical.

the large, reddish-orange digestive gland seen in sea angels, which is roughly located at the same place in the real-world slug bodies (although internally, of course).

Manaphy
(#490; Type: Water)

Class: Gastropoda (snails and slugs)

Order: Pteropoda (sea butterflies)

Suborder: Gymnosomata (sea angels)

Family: Clionidae

Genus: *Clione* Pallas, 1774

Species: *Clione limacina* (Phipps, 1774)

Manaphy is very similar in appearance to Phione and should also have been inspired by *Clione limacina*. So pretty much everything that was said about Phione also applies to Manaphy.

One thing tough, is the Tail Glow move: "The user stares at flashing lights to focus its mind, drastically raising its Sp. Atk stat." This move is a possible nod to the phenomenon of bioluminescence, which consists on the production and emission of light by living organisms. Although widespread among marine invertebrates, like jellyfish, bioluminescence is known from very few nudibranchs: just the genus *Plocamopherus* Rüppell & Leuckart, 1831 and the species *Phylliroe bucephalum* Peron & Lesueur, 1810 (Herring, 1987; Lalli & Gilmer 1989; Haddock et al., 2010). Bioluminescence has never been documented in *Clione*.

Shelmet
(#616; Type: Bug)

Class: Cephalopoda (squid, octopuses and nautiluses)

Order: Nautilida (nautiluses)

Family: Nautilidae

Genus: *Nautilus* Linnaeus, 1758 or Allonautilus Ward & Saunders, 1997

With a very characteristic spiral shell-like armor, Shelmet is at least partly based on cephalopods, more specifically those in the family Nautilidae, like the living genera *Nautilus* and *Allonautilus*. As tragic as it may sound, the three living nautilus species are the only survivors of a once thriving group (Dunstan et al., 2011). The fossil record shows us that nautiluses were much more diverse and a multitude of genera existed a few hundred million years ago. This diversity suffered its ups and downs, with a strong decline in the Miocene (roughly 23 to 5 million years ago) and Pliocene (5 to 2.5 million years ago), and most lineages did not survive to this day.

Nautilus sp. (J. Baecker, 2007).

Nevertheless, Shelmet is very akin to living nautiluses, starting with the shell: it is tubular and coiled in a single horizontal plane (planispiral), and bears a triangular knight's helmet visor that is very similar to the hood nautilids have (also called aptychus). The position of the body in relation to the shell is correct in Shelmet, contrary to Omanyte/Omastar seen above (nautiloids and ammonoids are closely related, sharing a basic body plan).

The angry cartoonish eyes with vertical pupils also appear to have been inspired by real-world nautilid eyes. The vertical pupils are, in fact, holes: nautiluses have pinhole eyes which lack the solid lens that squid and octopuses (as well as humans) have. Shellmet's funny looking puckered-up mouth is also reminiscent of the real animal's funnel (hyponome), even though the real-world structure is used for propulsion, and not for kissing. On the other hand, Shelmet lacks the numerous small, smooth tentacles (called cirri) that are very striking in the real-world nautilids – our guess is that they would probably make the design messy or simply too hard to draw/animate.

At 0.4 m length and 7.7 kg, Shelmet is also way larger than any living nautilid species, which reach up to 0.25 m in width at most (Pisor, 2008). Extinct species of the family Endoceratidae (of uncoiled nautiloids) though, might have reached more than 3 m in shell length (Flower, 1955; Teichert & Kummel, 1960; Teichert, 1964; Frey, 1995).

Naturally, Shelmet has the ability "Shell Armor" and this is rather literal for this Pokémon: its shell was clearly inspired by the armors of medieval knights, as can be seen by its visor and its evolution. Shelmet's evolution is very complicated in-game: when traded with Karrablast, Shelmet evolves into Escavalier, which looks like a bug wearing Shelmet's shell and "visor" (or perhaps a hermit crab?). Meanwhile, Karrablast evolves into Accelgor, which looks like an insect pupa with a slightly coiled (shell-like) head. This mix-up of insectoid features explains why Shelmet is a Bug type. In any case, any mollusk resemblance is (sadly) lost in the evolutions, so we won't consider them here.

Inkay
(#686; Type: Dark /Psychic)

Class: Cephalopoda (squid, octopuses and nautiluses)

Subclass: Coleoidea (octopuses, squids, and cuttlefish)

Order: Teuthida (squids) or Sepiida (cuttlefish)

Inkay seems to be a very stylized teuthid or sepiid cephalopod: respectively a squid or a cuttlefish. We do believe it is more of a squid than a cuttlefish, however: Inkay has a very characteristic squid-like figure, with a triangular body (mantle), a somewhat discernible head, arms and stylized tentacles. Moreover, the tentacles of real-world cuttlefish, are "hidden" inside the 8 arms, which is not the case of Inkay – like real-world squids, the tentacles are showing, though their lateral position is odd (they are centralized in real-world squids).

The size informed by the Pokédex is well within the real-world range at 0.4 m length and weighing up to 3.5 kg. Squids can go from millimeters to several meters long: the giant squid, *Architeuthis dux* Steenstrup, 1857, can reach 18 m (Clarke, 1966; Roeleveld & Lipinski, 1991; Salvador & Tomotani, 2014), while the colossal squid, *Mesonychotheuthis hamiltoni* Robson, 1925, can weigh whopping 500 kg (Salvador, 2019).

The designers deserve some praise for actually making the mouth look like a beak for this Pokémon, like in real-world cephalopods. Unfortunately, they put it on the

wrong place. Real-world cephalopods have their mouth (and beak) sheltered in the middle of the arms and tentacles.

Top: *Loligo vulgaris* Lamarck, 1798 (H. Hillewaert, 2005). Bottom: *Sepia officinalis* Linnaeus, 1758 (J. Carvalho, 2006).

Inkay's abilities and moves were also clearly inspired by cephalopod biology. The "Suction Cups" ability is a nod to cephalopod suckers (see Octillery above), which are normally arranged in rows along their arms and at the tip of their tentacles (for differences between arms and tentacles, see Salvador & Cunha, 2016). Though the move "Constrict" may seem logical at first sight, it is actually erroneous: contrary to popular myth, cephalopods cannot constrict something with their tentacles as if they were snakes (Roper & Boss, 1982). The move "Peck" is a reference to a cephalopod beak, although they cannot peck their prey like birds would. Rather, they use the beak to tear small chunks of their prey.

The move "Hypnosis" employs hypnotic suggestion to make the target fall into a deep sleep. This is a reference to real-world cuttlefish. Coleoid cephalopods can change their body color and color patterns using specialized skin cells called cromatophores. They can change color almost instantly and can produce patterns as if their skin were a TV screen.[4] The animals use this ability to camouflage[5] themselves (either to evade predators or to ambush prey), to communicate with their kin, or to scare off predators (Hanlon & Messenger, 1996; Hanlon, 2007; Mäthger et al., 2012). However, some scientists suggest a fourth kind of use for the color-changing ability: the patterns produced would mesmerize prey and make them easier to catch, which could be interpreted as a kind of hypnosis (Mauris, 1989; Mather & Mather, 2006; Thomas & MacDonald, 2016). This ability in real cephalopods, however, remain far from proven.

Malamar
(#687; Type: Dark / Psychic)

Class: Cephalopoda (squid, octopuses and nautiluses)

Subclass: Coleoidea (octopuses, squids, and cuttlefish)

Order: Teuthida (squids)

More so than Inkay, Malamar's design is clearly based on a squid, with an elongated body with triangular wing-like fins, and two long well-defined tentacles. The fierce, evil look is just a bonus. Oddly though, Malamar

[4] Shamefully, neither Inkay/Malamar nor Octillery have the ability "Color Change". The only Pokémon with this ability is Kecleon, which is based on a chameleon. Just for the record, a chameleons' ability to change color is laughable when compared to cephalopods.

[5] Even though octopuses are the masters of camouflage, Octillery does not learn the move "Camouflage". Inkay, however, can learn it through the intricate (and rather annoying) process of Pokémon breeding.

is basically upside down. Real-world squids do not swim in this position; they are usually horizontally or vertically oriented with the arms and tentacles pointing downward. However, some squids (*e.g.*, family Cranchiidae) do remain on this upside-down position with the arms held upwards: this is known to scientists as the "cockatoo position." This inversion in position is linked to the way Inkay evolves into Malamar: the player must hold the Nintendo 3DS system upside-down for Inkay to evolve.

In any case, everything else that was said about Inkay applies to Malamar, including the moves/abilities (which are identical), the beak-like mouth (and its odd placement), and the size range (1.5 m, 47 kg; respectable, but much smaller than some real-world squids).

Goomy
(#704; Type: Dragon)

Class: Gastropoda (snails and slugs)

Order: Nudibranchia (sea slugs)

Family: Chromodorididae

Genus: *Goniobranchus* Pease, 1866

Goomy is yet another Pokémon probably designed after sea slugs[6] (most likely Nudibranchia), though it is neither a Water-type nor marine. Goomy's "antennae" are very similar to structures of sea slugs called rhinophores, which are scent or taste receptors (chemosensory structures) situated on the dorsal surface of the animal's head (Wertz et al., 2007; Cummins et al., 2009). The overall shape of its body is a very generic design of a sluggish creature, and the color pattern is somewhat reminiscent of species such as *Goniobranchus kuniei* (Pruvot-Fol, 1930) or *Goniobranchus geminus* (Rudman, 1987).

Interestingly, Goomy (and its evolved forms) are Dragon-type Pokémon. This is a possible reference to the so-called blue dragon sea slug, *Glaucus atlanticus* Forster, 1777, though the design is not even vaguely similar to it. Goomy's size (0.3 m, 2.8 kg) is well within that of real-world sea slugs (see Gastrodon's entry above).

Goniobranchus kuniei (Pruvot-Fol, 1930) (S. Childs, 2006).

Goomy's abilities are clearly inspired by mollusk physiology. The "Gooey" ability lowers the attacker's Speed stat upon contact, a nod to the mucus production that is typical of snails and slugs, but usually more conspicuous in terrestrial species (Cameron, 2016). Despite being based on sea slugs, Goomy is fully terrestrial and accordingly gooey. "Hydration" is an ability that heals status conditions when it's raining. Conserving water in terrestrial environments is hard for moist-bodied creatures like snails and slugs and a good deal of their evolutionary history has to do with this (Barker, 2001). The relationship between snails/slugs and the rain is very clear, as they will be found out and about after a good rain.

[6] *Bulbapedia* indicates the fossil *Wiwaxia* Walcott, 1911 as a possible inspiration. However, there are very strong arguments against this: (1) These fossils are widely unknown. If *Pokémon* designers can't even place the mouth of an octopus in the right place (see Octillery, Inkay and Malamar), they likely didn't know about this animal. (2) Wiwaxiids might not actually be mollusks; their position in the tree of life is still hotly debated by scientists. All of Goomy's abilities, Pokédex entries, moves, etc. point towards a mollusk. (3) The morphology is completely different: wiwaxiids were covered by hard plates and spines, like a medieval-looking tank. Likely no soft portion of their body was visible from the outside. Goomy is all soft and cute.

Sliggoo
(#705; Type: Dragon)

Class: Gastropoda (snails and slugs)

Superorder: Eupulmonata (pulmonate snails and slugs)

Order: Stylommatophora or Ellobiida

Top: *Eucobresia diaphana* (Draparnaud, 1805) (J. Grego, 2004; www.animalbase.uni-goettingen.de). Bottom: *Omalonyx convexus* (Heynemann, 1868) (courtesy of L. Charles).

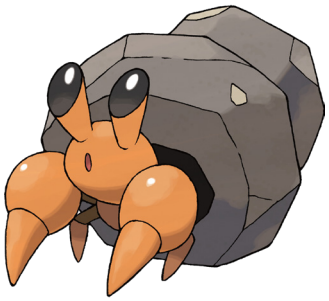
Contrary to Goomy, Sliggoo seems fully based on a terrestrial snail, though it retains some of the characteristics of sea slugs (*e.g.*, the "rhinophores" on the dorsal surface of the head) and is thus, kind of a gestalt. These rhinophores, however, can now also be interpreted as the sensory tentacles of land snails. If that is the case, we can see that Sliggoo's eyes are positioned on the base of the tentacles. Most eupulmonates have the eyes on top of the eyestalks (order Stylommatophora), with only a few (order Ellobiida) having eyes on the base of the stalks. However, no ellobiid is known to be semi-slug or slug-like, as Sliggoo is (see below). Once again, this Pokémon seems to be a mixture of forms.

Sliggoo has a spiral "hump" of sorts, which resembles a vestigial shell found in the so-called semi-slugs. These gastropods are, so to speak, halfway through the process of limacization.

The name seems to be derived from words such as slippery, slimy and goo, which is yet another reference to the mucus produced by mollusks in general. In any case, compared to real-world snails and slugs, its erect posture is wrong (see Slugma above). Likewise, its large size (0.8 m, 17.5 kg) is problematic (see Magcargo and Goomy above). Sadly, Sliggoo does not become a slug or a snail later on: it evolves into Goodra, which completely loses its resemblance to mollusks, looking more like a cartoonish dragon/dinosaur creature. It is still slimy, though.

MOLLUSK OR NOT?

There is one Pokémon that is not a mollusk, but which deserves a brief mention here: Dwebble (#557; Type Bug / Rock).



This Pokémon is based on a hermit crab. This group of crustaceans, the superfamily Paguroidea, is typically marine, although there are some terrestrial forms (Dwebble itself is terrestrial). Hermit crabs are remarkable for using the empty shells of gastropods as protection: they choose their shell

carefully, carry them around and change shells when they grow and/or when they find a better one.

Dwebble, however, does not use a gastropod shell; it uses a piece of rock. Curiously, some terrestrial hermit crabs use fossilized gastropod shells (Haas, 1950) and that is as close to a rock as one can get. Dwebble, though, does not have that many options: the only gastropod shell available to it would be that of a Magcargo, which is way too large. Other options would be the shells of the ammonoid-Pokémon Omanyte/Omastar, but they are fossils that need to be "resurrected", which would make Dwebble's life much more difficult. Although hermit crabs using ammonoid shells may sound strange, there is evidence that fossil hermit crabs from the early Cretaceous period (circa 130 million years ago) actually used them (Fraaije, 2003).

On a similar case, there is a report of a hermit crab, called *Diogenes heteropsammicola* Igawa & Kato, 2017, using a coral instead of a shell. This species lives in southern Japan (Igawa & Kato, 2017) and it actually looks rather similar to Dweeble. That, however, would be a large coincidence, as this species was only discovered after Gen V had been released.

Diogenes heteropsammicola (Igawa & Kato, 2017).

Awkwardly, Dweeble is called "Rock Inn Pokémon" and that's likely because the official "Hermit Crab Pokémon" is Slowbro (#080; Type Water / Psychic), from Gen I.

The problem is, Slowbro is not a crab: its design is clearly based on a mammal. It does have a shell-like structure attached to its tail, though, which is (according to lore) a living Shellder. There are some further problems with this: first, that "Shellder" is still alive, so it would be a case of symbiosis, not of a crab using an empty shell. Secondly, the "Shellder" is now arranged spirally, like if he transformed from a bivalve into a gastropod. However, if one looks closely, the shell is not actually a spiral, but just a hollowed-out structure that looks like a chocolate cornet. In fact, the cornet-thing has a pair of angry eyes, so it is definitely neither a shell nor a mollusk. Thus, Slowbro is just a pile up of mistakes: a crab that's a mammal carrying a mollusk that's at best a sentient pastry.[7]

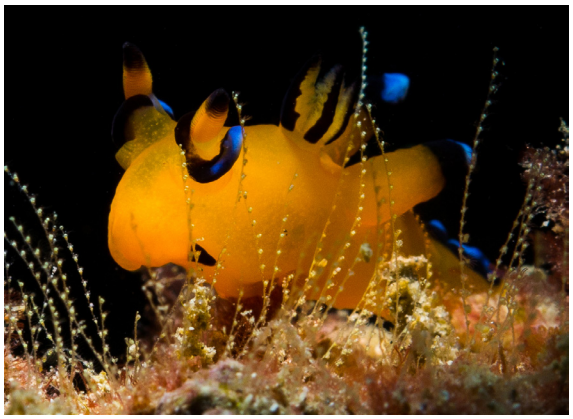
Cornet (Ayy753771, 2017; Cooking Mama Wiki).

REAL LIFE POKÉMON?

There is one notable rea-life mollusk whose name was inspired by *Pokémon* – its

[7] If you think sentient desserts are too wacky, even for *Pokémon*, please refer to Vanillite, Vanillish, Vanilluxe, Swirlix, and Slurpuff.

popular name, at least. The "Pikachu slug" is a nudibranch from the Indian Ocean and Western Pacific that got the attention of the Japanese public on the Internet. It is a tiny yellow/orange-ish creature with black tips on its rhinophores and gills. It is virtually impossible not to think of Pikachu when looking at it. Even though its popularity is quite recent, the species was discovered and described in the late 19th century; its scientific name is *Thecacera pacifica* Bergh, 1883 (family Polyceridae).



Thecacera pacifica (Olakhalaf, 2017).

CONCLUSIONS

Most of the Pokémon designs are in line with real-world mollusks, although there are some cringeworthy mistakes, like Omanyte/Omastar's body position, Octillery's mouth/funnel controversy, and Inkay/Malamar's beak position. The moves and abilities nicely reflect some mollusk features and, well, abilities, but there is also some crazy stuff added on the mix, like "Shell Smash" and "Spike Cannon".

As we highlighted in the beginning of this article, there are between 70,000 and 200,000 species of mollusks (Rosenberg, 2014). In comparison, there are only circa 6,000 species of mammals (Burgin et al., 2018). Overall, there are 17 molluscan Pokémon among the current 809 monsters. This number clearly does not reflect true animal biodiversity, similar to other misrepresented invertebrates in the franchise, such as arthropods (Prado & Almeida, 2017; Kittel, 2018). Obviously, people prefer to see cats and doggos so there are plenty of Pokémon based on them, domestic or otherwise. Even so, there are some animal groups, mollusks or otherwise, that deserve better representation in *Pokémon*, such as velvet worms (Onychophora) and bristle worms (Polychaeta). They would make much more interesting monsters than yet another lion.

REFERENCES

Aguado, F. & Marin, A. (2007) Warning coloration associated with nematocyst-based defences in aeolidiodean nudibranchs. Journal of Molluscan Studies 73: 23–28.

Barker, G.M. (2001) The Biology of Terrestrial Molluscs. CABI, Wallingford.

Behrens, D. (1992) Pacific Coast Nudibranchs. Second edition. Sea Challengers, Monterey.

Bouchet, P.; Rocroi, J.P.; Bieler, R.; Carter, J.G.; Coan, E.V. (2010) Nomenclator of bivalve families with a classification of bivalve families. Malacologia 52: 1–184.

Bouchet, P.; Rocroi, J.-P.; Hausdorf, B.; Kaim, A.; Kano, Y.; Nützel, A.; Parkhaev, P.; Schrödl, M.; Strong, E.E. (2017). Revised classification, nomenclator and typification of gastropod and monoplacophoran families. Malacologia 61: 1–526.

Burgin, C.J.; Colella, J.P.; Kahn, P.L.; Upham, N.S. (2018) How many species of mammals are there? Journal of Mammalogy 99: 1–14.

Cameron, R. (2016) Slugs and Snails. William Collins, London.

Cavallari, D.C. (2015) Shells and bytes: mollusks in the 16-bit era. Journal of Geek Studies 2(1): 28–43.

Clarke, M.R. (1966) A review of the systematics and ecology of oceanic squids. Advances in Marine Biology 4: 91–300.

Cummins, S.F.; Erpenbeck, D.; Zou, Z.; Claudianos, C.; Moroz, L.L.; Nagle, G.T. & Degnan, B.M. (2009) Candidate chemoreceptor subfamilies differentially expressed in the chemosensory organs of the mollusc *Aplysia*. BMC Biology 7: 28.

Double, T. (1992) Here be giants. BBC Wildlife 10: 34–40.

Dunstan, A.J.; Ward, P.D.; Marshall, N.J. (2011) *Nautilus pompilius* life history and demo-

graphics at the Osprey Reef Seamount, Coral Sea, Australia. PLoS ONE 6: e16312.

Engeser, T. (1996) The position of the Ammonoidea within Cephalopoda. In: Landman, N.H.; Tanabe, K.; Davis, R.A. (Eds.) Ammonoid Paleobiology. Plenum Press, New York. Pp. 3–19.

Flower, R.H. (1955) Status of endoceroid classification. Journal of Paleontology 29: 329–371.

Fraaije, R.H.B. (2003) The oldest in situ hermit crab from the Lower Cretaceous of Speeton, UK. Palaeontology 46: 53–57.

Fredericks, A.D. (2014) The Secret Life of Clams: The Mysteries and Magic of Our Favorite Shellfish. Skyhorse, New York.

Frey, R.C. (1995) Middle and Upper Ordovician nautiloid cephalopods of the Cincinnati Arch region of Kentucky, Indiana, and Ohio. U.S. Geological Survey Professional Papers 1066-P: 1–73.

Haas, F. (1950) Hermit crabs in fossil snail shells in Bermuda. Ecology 31: 152.

Haddock, S.H.D.; Moline, M.A.; Case, J.F. (2010) Bioluminescence in the sea. Annual Review of Marine Science 2: 443–493.

Hanlon, R.T. (2007) Cephalopod dynamic camouflage. Current Biology 17: 400–404.

Hanlon, R.T. & Messenger, J.B. (1996) Cephalopod Behaviour. Cambridge University Press, Cambridge.

Hartis, C. (2011) *Enteroctopus dofleini*. Animal Diversity Web. Available from: http://animaldiversity.ummz.umich.edu/site/accounts/information/Enteroctopus_dofleini.html (Date of access: 11/May/2019).

Hermans, C.O. & Satterlie, R.A. (1992) Fast-strike feeding behaviour in a pteropod mollusk, *Clione limacina* Phipps. Biological Bulletin 182: 1–7.

Herring, P.J. (1987) Systematic distribution of bioluminescence in living organisms. Journal of Bioluminescence and Chemiluminescence 1: 147–163.

High, W.L. (1976) The giant pacific octopus. Marine Fisheries Review 38(9): 17–22.

Hutcheon, G. (2010) On the origin of species: Manaphy and Phione. Bulbanews. Available from: https://bulbanews.bulbagarden.net/wiki/On_the_Origin_of_Species:_Manaphy_and_Phione (Access date: 11/May/2019).

Igawa, M. & Kato, M. (2017) A new species of hermit crab, *Diogenes heteropsammicola* (Crustacea, Decapoda, Anomura, Diogenidae), replaces a mutualistic sipunculan in a walking coral symbiosis. PLoS ONE 12(9): e0184311.

Kittel, R.N. (2018) The entomological diversity of Pokémon. Journal of Geek Studies 5(2): 19–40.

Knop, D. (1996). Giant Clams: A comprehensive guide to the identification and care of tridacnid clams. Dähne Verlag, Ettlingen.

Lalli, C.M. & Gilmer, R.W. (1989) Pelagic Snails: The biology of holoplanktonic gastropod mollusks. Stanford University Press, Stanford.

Lurker, M. (1987) The Routledge Dictionary of Gods and Goddesses, Devils and Demons. Routledge & Kegan Paul, London.

Mather, J.A. & Mather, D.L. (2006) Apparent movement in a visual display: the 'passing cloud' of *Octopus cyanea* (Mollusca: Cephalopoda). Journal of Zoology 263: 89–94.

Mäthger, L.M.; Bell, G.R.R.; Kuzirian, A.M.; Allen, J.J.; Hanlon, R.T. (2012) How does the blue-ringed octopus (*Hapalochlaena lunulata*) flash its blue rings? Journal of Experimental Biology 215: 3752–3757.

Matsumoto, M. & Hayami, I. (2000) Phylogenetic analysis of the family Pectinidae (Bivalvia) based on mitochondrial cytochrome C oxidase subunit I. Journal of Molluscan Studies 66: 477–488.

Mauris, E. (1989) Colour patterns and body postures related to prey capture in *Sepiola affinis* (Mollusca: Cephalopoda). Marine Behaviour and Physiology 14: 189–200.

Mendes, A.B.; Guimarães, F.V.; Eirado-Silva, C.B.P.; Silva, E.P. (2017) The ichthyological diversity of Pokémon. Journal of Geek Studies 4(1): 39–67.

Monks, N. & Palmer, P. (2002) Ammonites. Smithsonian Books, Washington, D.C.

Morton, B. (2008) The evolution of eyes in the bivalvia: new insights. American Malacological Bulletin 26: 35–45.

Pisor, D.L. (2008) Registry of World Record Size Shells. Fifth edition. ConchBooks, Hackenheim.

Prado, A.W. & Almeida, T.F.A. (2017) Arthropod diversity in *Pokémon*. Journal of Geek Studies 4(2): 41–52.

Roeleveld, M.A.C. & Lipinski, M.R. (1991) The

giant squid *Architeuthis* in southern African waters. Journal of Zoology 224: 431–477.

Roper, C.F.E. & Boss, K.J. (1982) The giant squid. Scientific American 246: 96–105.

Rose, C. (2001) Giants, Monsters, and Dragons: an encyclopedia of folklore, legend, and myth. W.W. Norton & Company, New York.

Rosenberg, G. (2014) A new critical estimate of named species-level diversity of the recent Mollusca. American Malacological Bulletin 32: 308–322.

Salvador, R.B. (2014) Praise Helix! Journal of Geek Studies 1: 9–12.

Salvador, R.B. (2017) The unexplored potential of video games for animal conservation. Tentacle 25: 3–5.

Salvador, R.B. (2019) Colossal squid. In: Waugh, S.M. (Ed.) 100 Natural History Treasures of Te Papa. Te Papa Press, Wellington. Pp. 58–59.

Salvador, R.B. & Cunha, C.M. (2016) Squids, octopuses and lots of ink. Journal of Geek Studies 3(1): 12–26.

Salvador, R.B. & Tomotani, B.M. (2014) The Kraken: when myth encounters science. História, Ciências, Saúde – Manguinhos 21: 971–994.

Sato, N.; Takeshita, F.; Fujiwara, E.; Kasugai, T. (2016) Japanese pygmy squid (*Idiosepius paradoxus*) use ink for predation as well as for defence. Marine Biology 163: 56.

Shumway, S.E. & Parsons, G.J. (2011) Scallops: Biology, Ecology and Aquaculture. Second edition. Elsevier, Amsterdam.

Teichert, C. (1964) Endoceratoidea. In: Moore, R.C. (Ed.) Treatise on Invertebrate Paleontology. Part K, Mollusca 3: Cephalopoda, General Features, Endoceratoidea, Actinoceratoidea, Nautiloidea, Bactritoidea. University of Kansas Press, Lawrence. Pp. 160–189.

Teichert, C. & Kummel, B. (1960) Size of endoceroid cephalopods. Breviora 28: 1–7.

Thomas, A. & MacDonald, C. (2016) Investigating body patterning in aquarium-raised flamboyant cuttlefish (*Metasepia pfefferi*). PeerJ 4: e2035.

Tomotani, B.M. (2014) Robins, robins, robins. Journal of Geek Studies 1: 13–15.

Waller, T.R. (2006) New phylogenies of the Pectinidae (Mollusca: Bivalvia): reconciling morphological and molecular approaches. In: Shumway, S.E. & Parsons, G.J. (Ed.) Scallops: Biology, Ecology and Aquaculture. Second edition. Elsevier, Amsterdam. Pp. 1–44.

Ward, P. (1981) Shell sculpture as a defensive adaptation in ammonoids. Paleobiology 7: 96– 100.

Wertz, A.; Rössler, W.; Obermayer, M.; Bickmeyer, U. (2007) Functional neuroanatomy of the rhinophore of *Archidoris pseudoargus*. Helgoland Marine Research 61(2): 135–142.

Wesselingh, F.P. & Gittenberger, E. (1999) The giant Amazonian snail (Pulmonata: Acavidae) beats them all. The Veliger 42: 67–71.

About the author

Dr. **Rodrigo Salvador** is a zoologist and paleontologist who specializes in mollusks. Land snails are his favorites, but when it comes to Pokémon, he sticks with a sea slug instead: the West Sea Gastrodon. Even so, he walked 45 km with his Fire-type buddy Slugma in *Pokémon Go* (when it was still rare) so it could evolve.

Daniel Cavallari is a taxonomist and marine biologist who loves mollusks and their shells. He's been collecting seashells and playing Pokémon games since he was a small boy. Though he prefers Pokémon of the older generations (I–III), he finds the newest mollusk-based Pokémon really amazing.