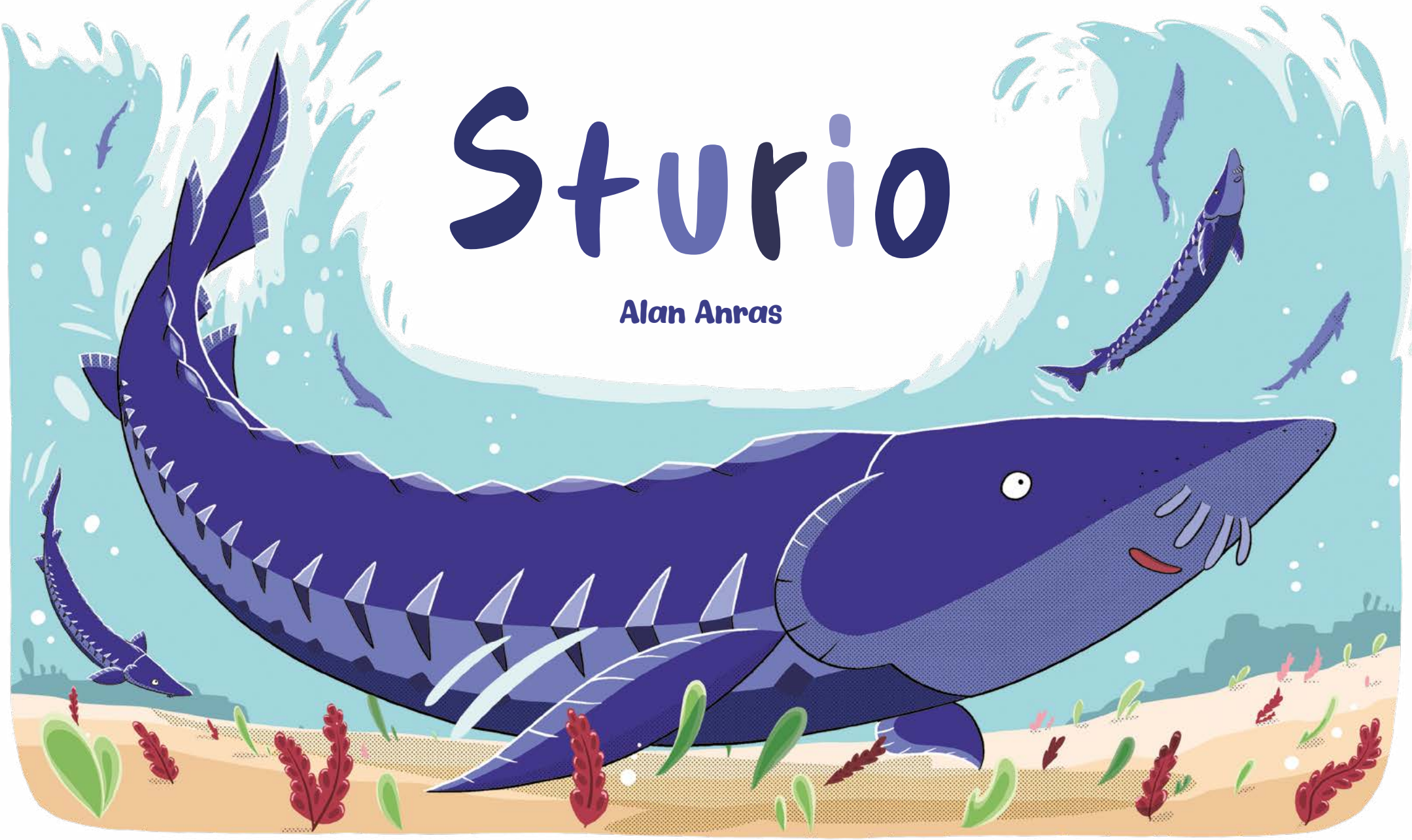
Sturio

Alan Anras



Sturio

Illustrated, written and translated to English by Alan Anras
under the direction of Marie-Laure Acolas.

2024/2025

alan-anras.fr

RÉPUBLIQUE FRANÇAISE
Liberté
Égalité
Fraternité

eau GRAND SUD-OUEST
AGENCE DE L'EAU ADOUR-GARONNE

RÉGION Nouvelle-Aquitaine

INRAE

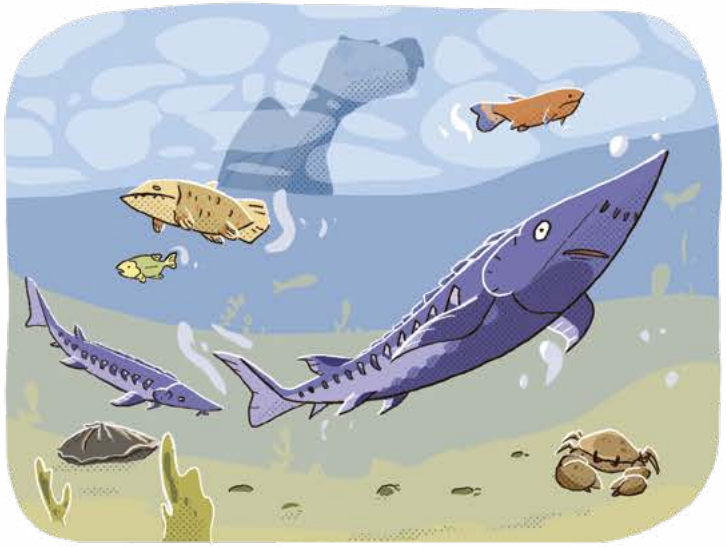
REVE

Plan National d'Actions
Esturgeon européen

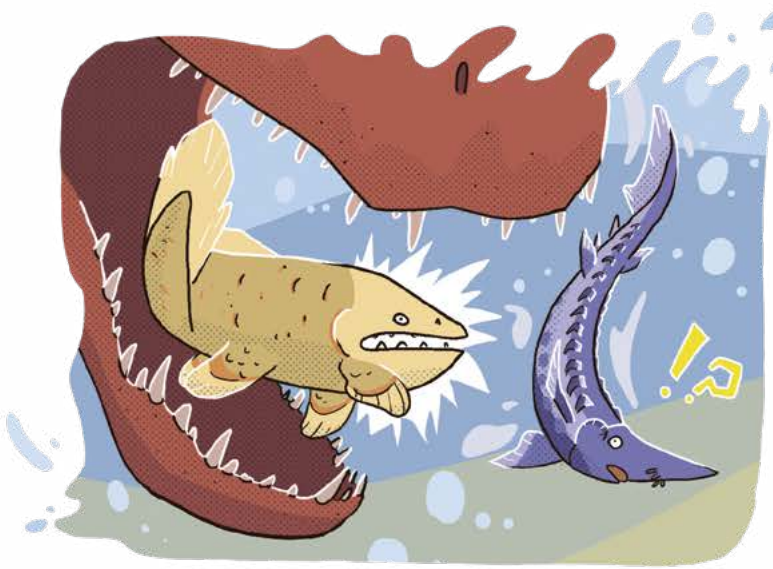
Chapter 1 :

What exactly is an European sturgeon ?

100 million years ago...



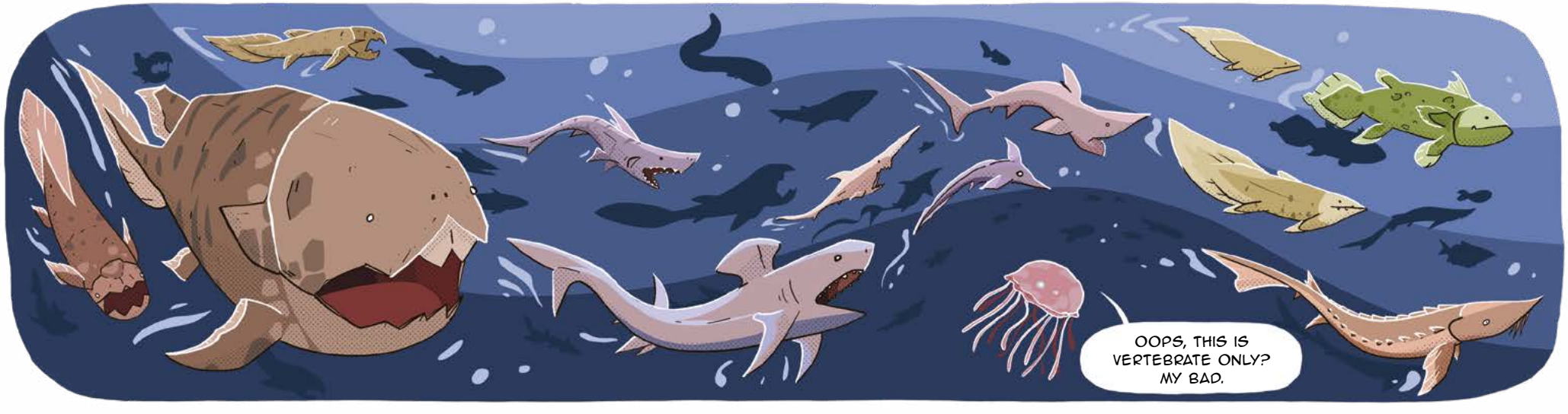
Sturgeons already populated the Earth's waters for 250 million years !



Among the descendants of this family, we meet the European sturgeon.

It's the greatest diadromous fish living in French waters, threatened with extinction.

This modern specie is actually part of a familly that harks back to the very first groups of fishes.



Sturgeons are part of the Chondrostei group. They are the only representatives of this group along with paddlefishes.

Actinopterygii (fishes)

Agnatha (doesn't have jaws)

About 100 species. Don't kiss them !

Gnathostomata (has jaws)

Placoderms (extinct)

We weren't there to count their numbers yet.

Osteichthyes (with bones)

Chondrichthyes (cartilagenous fishes)

About 1000 species of sharks, rays and chimaeras.

Sarcopterygii

Actinopterygii (ray finned fishes)

Rhypidistia

lungs

Tétrapoda

More or less anything that has or had legs and one or more lungs.

Lungfishes

6 species of fishes with lungs. Yes, that's quite unique.

Coelacanths

2 living species. That's more than the human species.

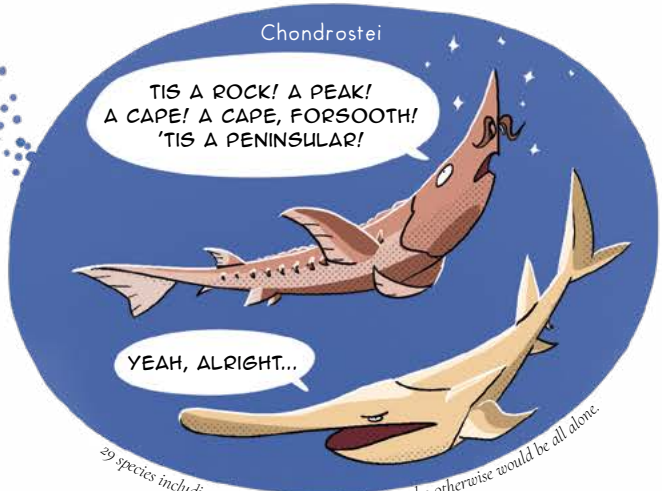
Téléostei

The vast majority of fishes, about 23 000 species.

Sturgeons are considered as living fossils. We call them that because they are closely related to their extinct relatives.

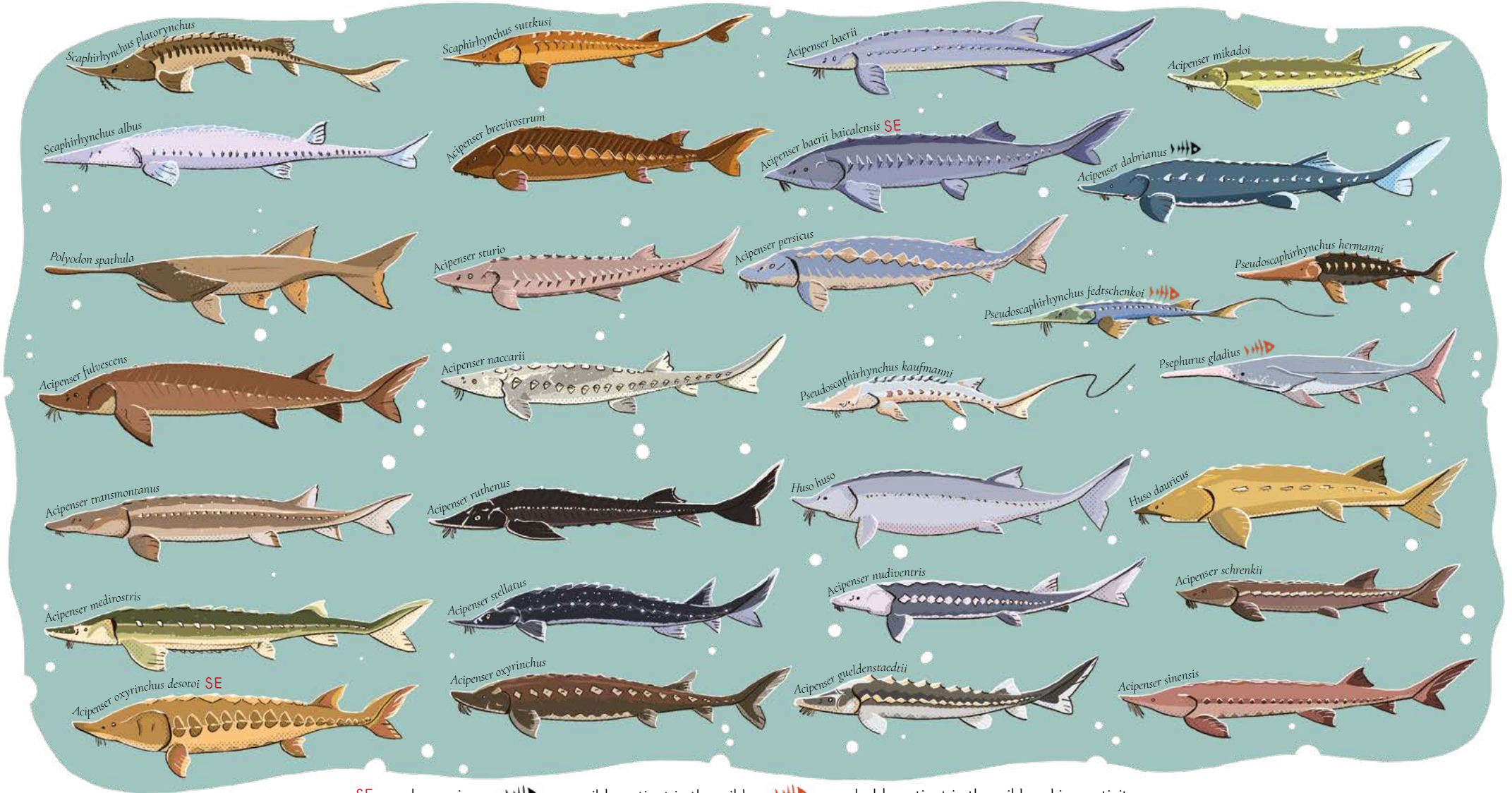
This group is defined by their long muzzle and their downward facing mouth. They possess small sensory barbels at the tip of their muzzle.

Chondrostei



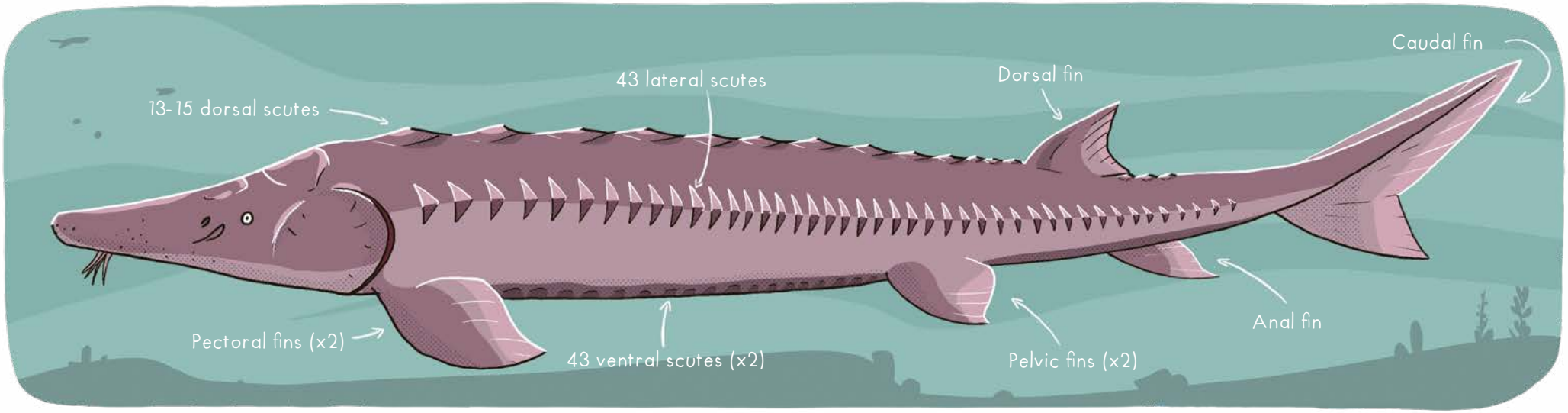
29 species including the 2 species of paddlefishes, who otherwise would be all alone.

Around the world, there are 27 sturgeon species (and two sub-species).
The last european wild species; this comic's subject, is the European sturgeon, called *Acipenser sturio*.

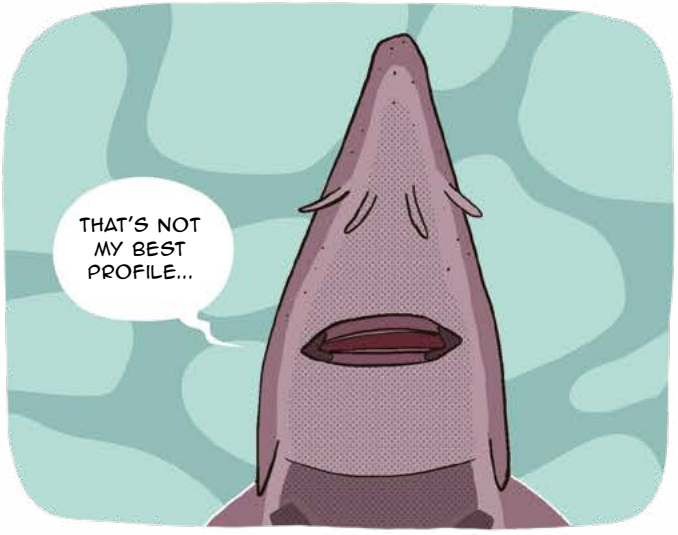


SE = sub-species = possibly extinct in the wild = probably extinct in the wild and in captivity

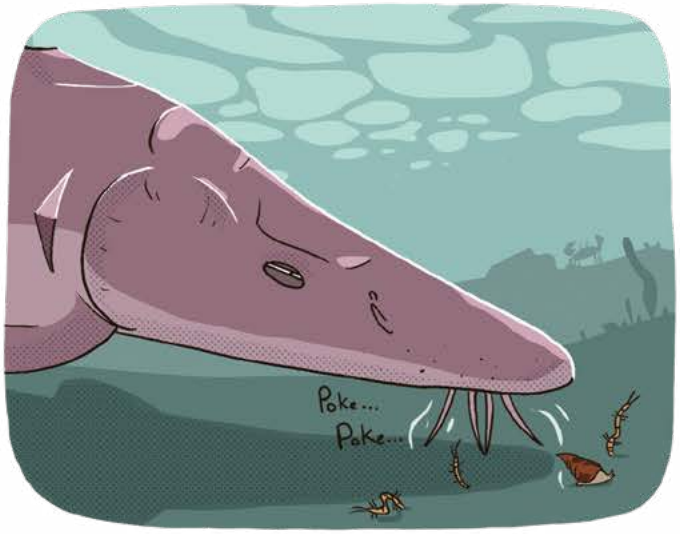
The European sturgeon, which we will now refer to as "sturio"
(from it's scientific name) is quite a good representative in the sturgeon family.



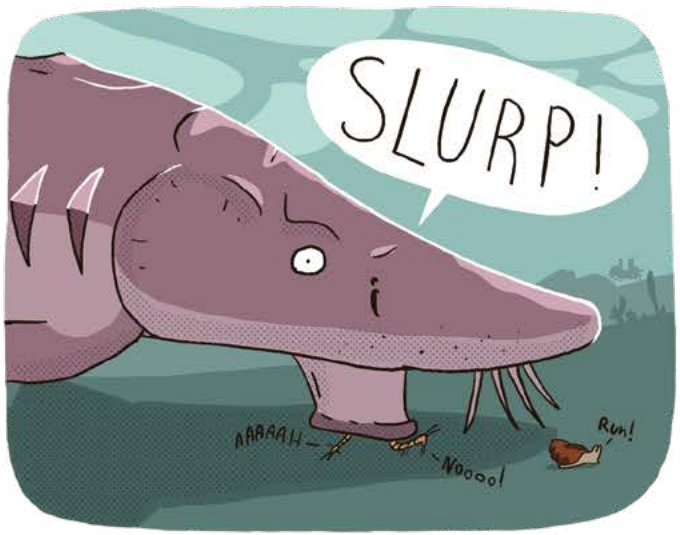
Sturgeons possess a protrusible mouth and sensitive barbels under their muzzle.



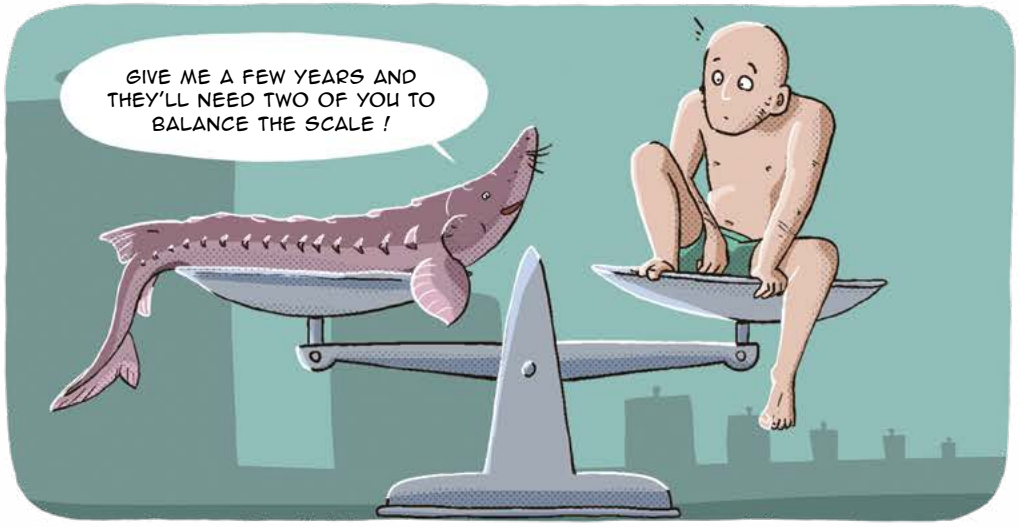
They use them to find worms and small molluscs or crustaceans in the seabed.



Once they find their prey, they suck it up by projecting their mouth, much like how carp do it.



Adults we can encounter nowadays measure from 1.5m to 2.4m and weight between 15 to 70 kg.

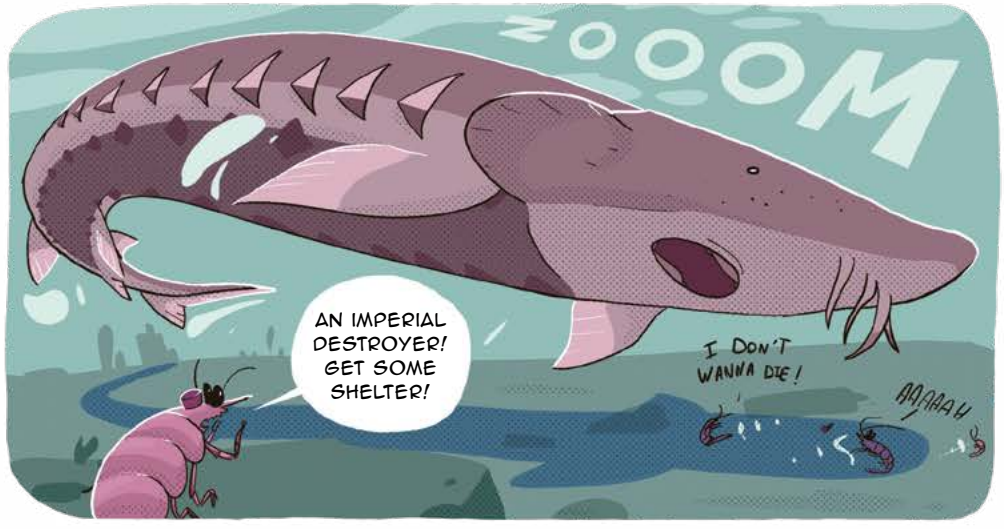


One of the greatest sturgeon was caught at Pauillac, in the Gironde, in 1944. It was 3.9m in length and weighed 300kg.

Picture from 1950 taken at Saint-Seurin d'Uzet, as an example.

Some individuals can exceed 3.5m and 300kg.

One of the biggest specimens caught in the Thames reached 350kg.



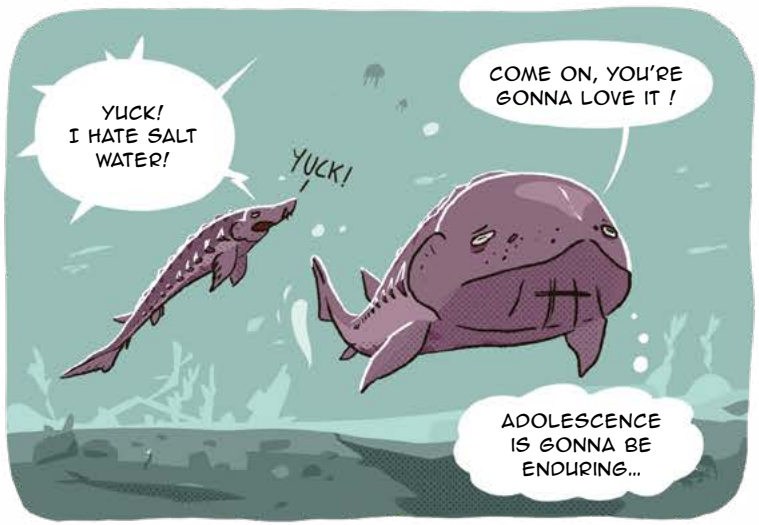
The European sturgeon is a protected migratory species in critical danger of extinction, much like the European eel.

It's a diadromous species: it can migrate from fresh water to salt water, and vice versa.

A diadromous species that grows at sea is anadromous when it climbs rivers to reproduce.

On the contrary, species are catadromous when they are born at sea and grow in rivers, as European eels do.

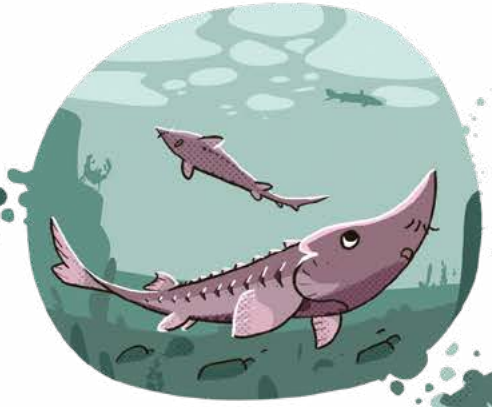
To migrate to their birthing place, sturios undergo a metabolic change, allowing them to travel from salt water to fresh water. They also experience this change in their early life, when young sturios leave the river to go to the ocean. Many different fish species can experience this kind of phenomenon.



The european sturgeon's life cycle.

Each female lays between 1 and 2 millions eggs to be fertilized by the males.

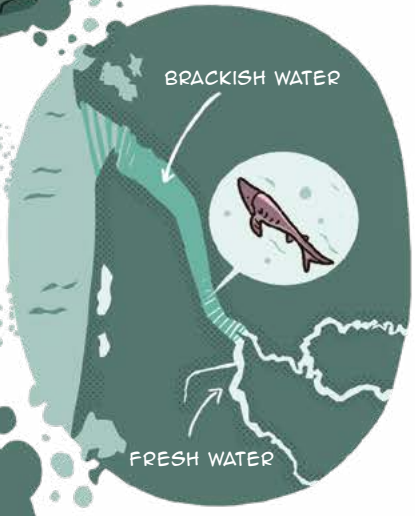
The eggs drift and fix themselves to the substrate to develop in a short week.



The larvae hatch and develop quickly in more mobile juveniles. They stay for a while near their breeding grounds during the summer following their birth.

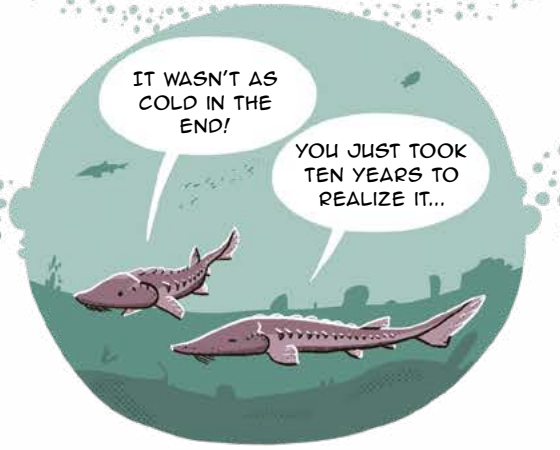
The adults that reach sexual maturity (12 years for the males, 16 years for the females) return to the river where they were born during spring to reproduce. They have a very long lifespan, between 40 to 50 years, and even between 80 and 100 years.

The young can swim downward to the estuary. They would stay in brackish waters during their first winter. Between 6 and 8 months they already measure between 20 and 30 cm. Most juveniles will travel and grow in the estuary until they reach 3 years.



At sea, the sturgeons disperse on the continental European shelf. They live on areas between 30 and 70m of depth, some even go as far as 100m.

Nowadays we can spot them from the North of Spain in Galicia to the North of western Europe, at the south of the norvegian coasts. But historically they were present from the black sea to the baltic sea and in Mediterranea.



Once they reach 3 years, they are able to live in a salty environment. Some will go live in the ocean, while others seem to keep going back and forth for unknown reasons. It may be due to environmental or feeding preferences.

Chapter 2 :

Mankind and the European sturgeon.

The sturgeon is a fish mankind has always known. In addition to archaeological remains such as fossils, humans have left imprints of their relationships with animals on the walls of caves.

Archaeologists have found sturgeon wall drawings made with red pigment from around 30,000 years ago.

There are traces of sturgeon consumption in antiquity. This fish was a gourmet dish both among the Greeks and the Romans.

According to Aristotle, sturgeon meat was a refined meal that could be found in lavish banquets.

Archaeological searches on the Ecorneboeuf site near the Isle river revealed sturio scutes dating from the first century and seashells imported from the shore. This suggests that the fish was kept fresh, or alive for consumption.

Art history testifies the consumption of sturgeons and the shrinking of their population in their natural habitat.

The many still life paintings of stalls or tables overflowing with fishery products bear witness to the frequency and diversity of fish consumed.

"The fish market", Frans Snyder, 1618

On observe la diminution de leurs occurences dans les peintures en même temps que les sturios perdaient en présence dans l'environnement dû à la pêche qui commençait à impacter l'espèce.

Sturgeons were famous meals at the table of the French kings and in the higher society. They were already being eaten for their meat and precious caviar.

In the 20-30s, the first warnings about population disappearing were raised by nature protection associations and professional fishermen.

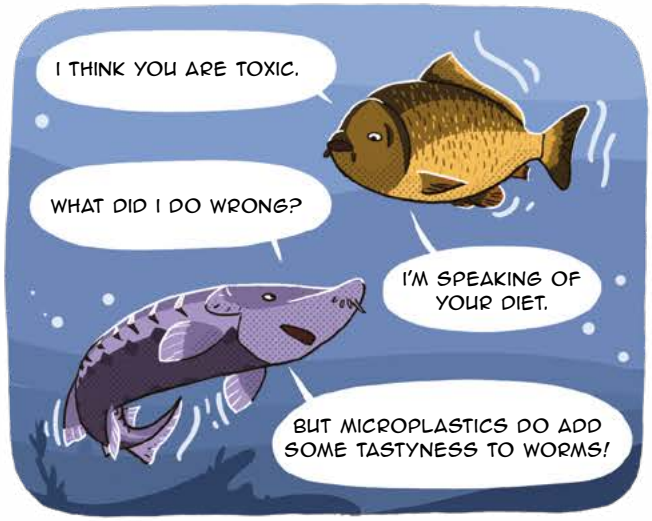
The population regressed and vanished because of the extraction of sand and pebbles in rivers...

...fishing for meat and eggs...

...the dams in the great rivers...

...the modification fo hydrological regimes...

...or the deterioration of the waters and pollution. Sturios having such a long lifespan, they accumulate toxic substances in their body during all of their life.

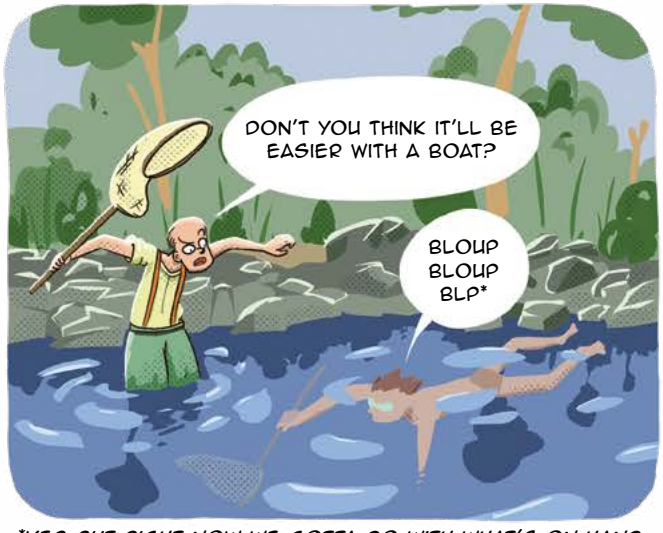


It's worth saying that in the 1930s, a 3m adult sturgeon could feed an entire village.

Over fishing of the adult population had a strong negative impact on reproduction during the 20th century.

The sturio's late reproduction leaves them very vulnerable.

Scientists then started to seriously ponder how little we knew about this species.



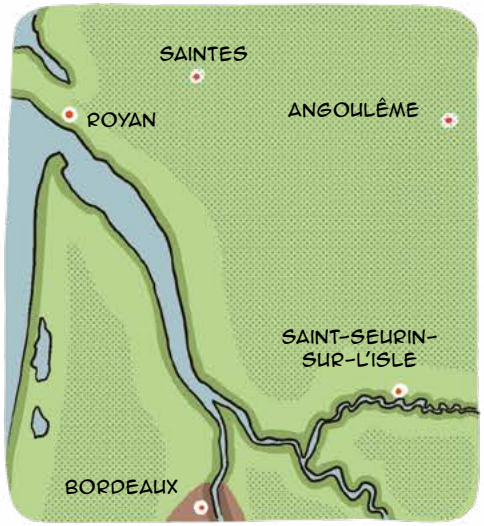
*YEP, BUT RIGHT NOW WE GOTTA DO WITH WHAT'S ON HAND.

For example, the first scientific fisheries in the River Gironde started in the 1980s.

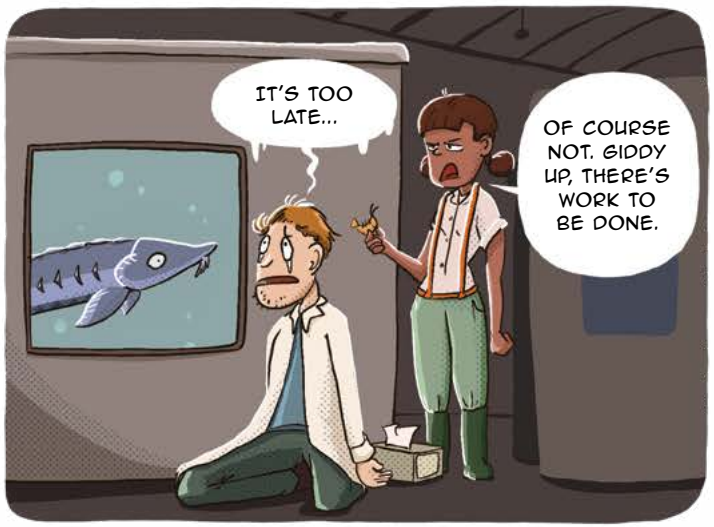
Alerts sent to the State gave rise to several laws: sturio fishing was banned in France in 1982, and in Europe in 1998.

In 1992, Europe, the State, environmental associations, fishermen, scientists, communities and many other stakeholders supported the establishment of a captive stock at St Seurin sur l'Isle. Since 1995, a second stock was established in Germany from sturios born in France.

In 1995, the State ordered that all sturios caught would be brought to the conservation centre at St Seurin sur l'Isle.



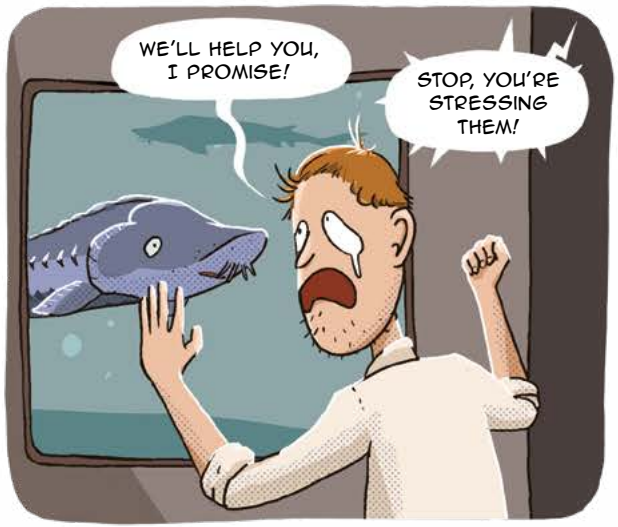
Despite the initial efforts, 1994 was the last reported sturio wild reproduction in the Garonne-Dordogne basin.



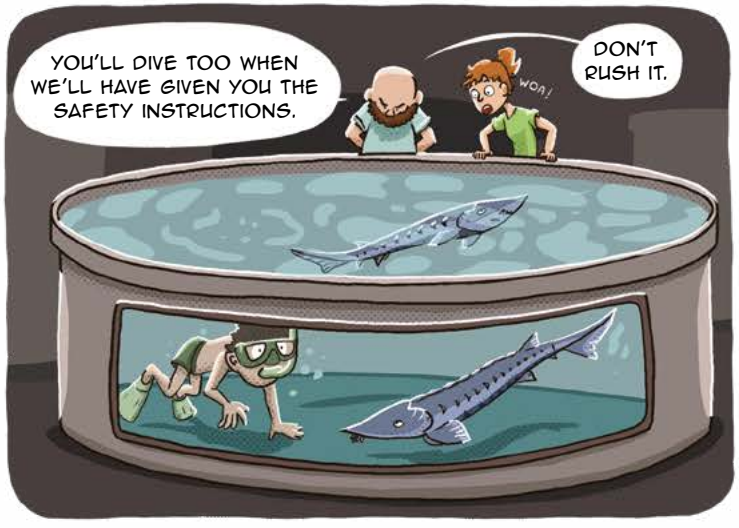
It's no doubt thanks to the conservation breeding of the last sturios in captivity that this species was able to be saved.

Their numbers were so low that the chances they would meet in their natural habitat were almost zero.

Their population was so low that a conservation and preservation program was implemented.

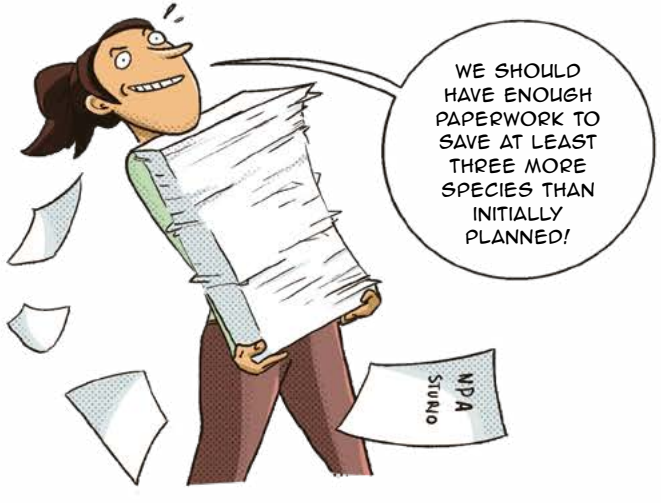


Scientists conduct research on the species to improve our knowledge and evaluate the restauration measures needed.



In 1995, the first assisted reproduction is a success, and many years later in 2007, a protocol is successfully applied and gives birth to several thousand of juveniles.

Then, in 2011 a national action plan in favour of the sturio was initiated, directed by the State.



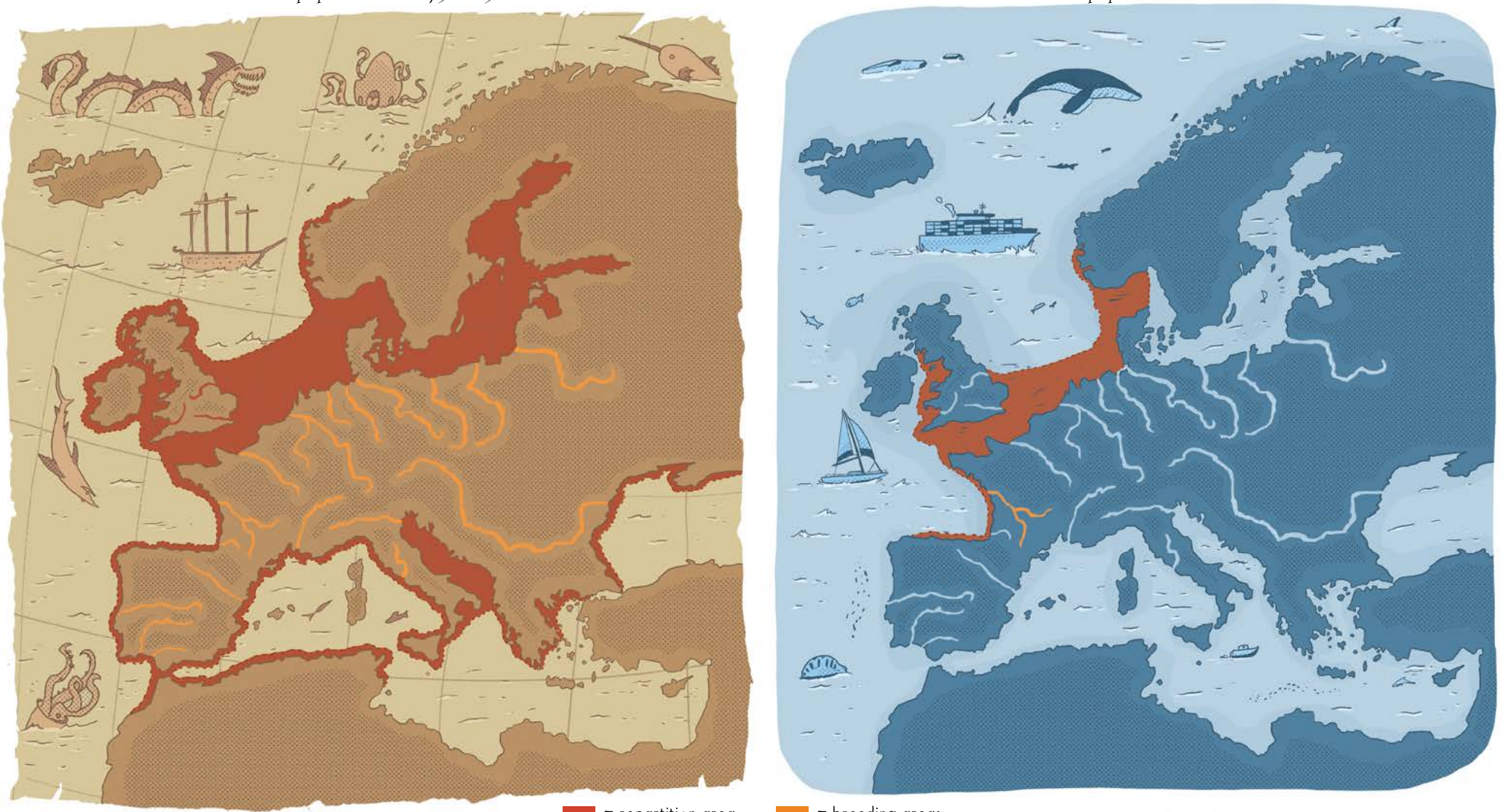
A National Action Plan (NPA) is a programme dedicated to the conservation or recovery of an important or endangered species.

Eurasian otter (Lutra lutra), European pond turtle (Emys orbicularis), yellow-bellied toad (Bombina variegata), ocellated lizard (Timon lepidus), Osprey (Pandion haliaetus) and dragonflies.

It's worth saying that the species reproduction area was greatly reduced over time. Initially, their breeding area included all the great European rivers, but their habitat's deterioration made the Garonne-Dordogne basin the sturio's last major reproductive area.

Sturio population in 1750-1850

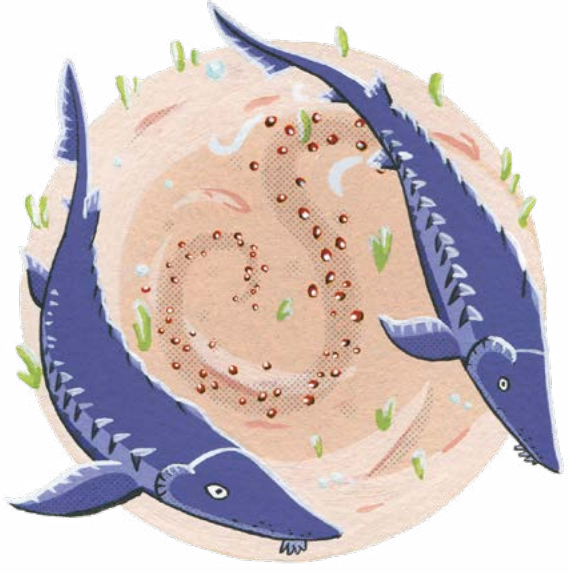
Sturio population in 2018



= repartition area = breeding areas

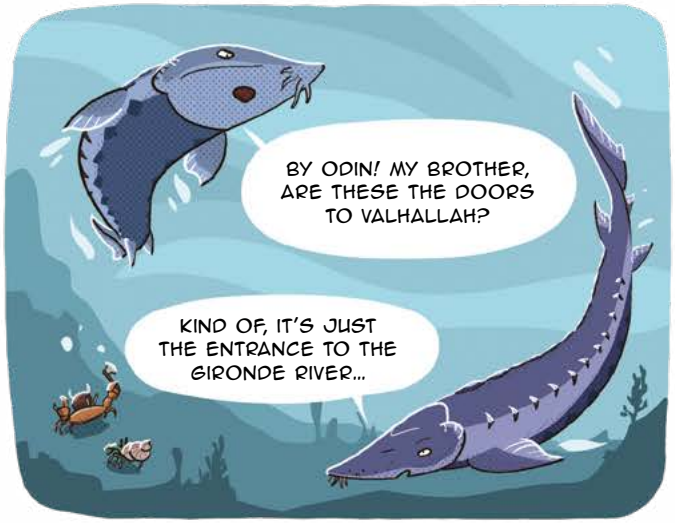
Chapter 3 :

The efforts to restore the species.



Sturios can be found on every European Red List and is affected by the Berne convention and the Oslo-Paris convention (OSPAR, the convention for the protection of the marine environment of the North-East Atlantic).

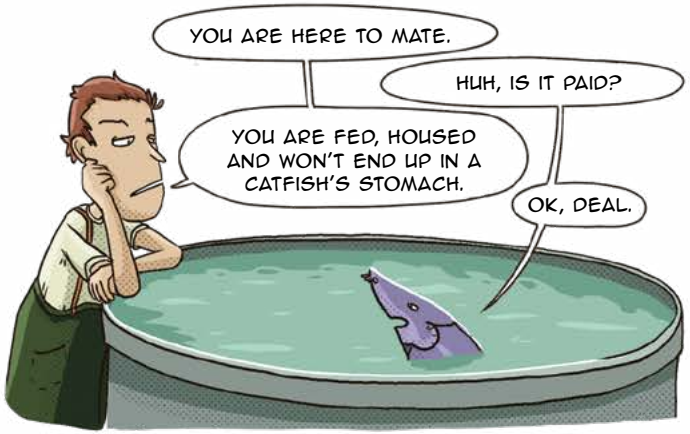
When the sturio was registered to the OSPAR convention in 2003, it was considered as extinct in almost all of its reproduction sites except in the Gironde basin.



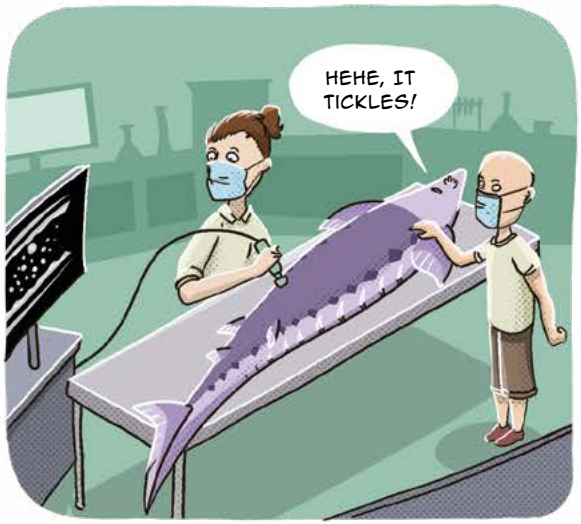
Sturios are ranked on the highest conservation level of the IUCN (International Union for the Conservation of Nature), just like the polar bear.

Polar bear (Ursus maritimus), Nepenthes, American burying beetle (Nicrophus americanus), Armenian birch mouse (Sicista armericana), Yangtze giant sofshell turtle (Rafetus swinhoei), Philippine crocodile (Crocodylus mindorensis), waved albatross (Phoebastria irrorata).

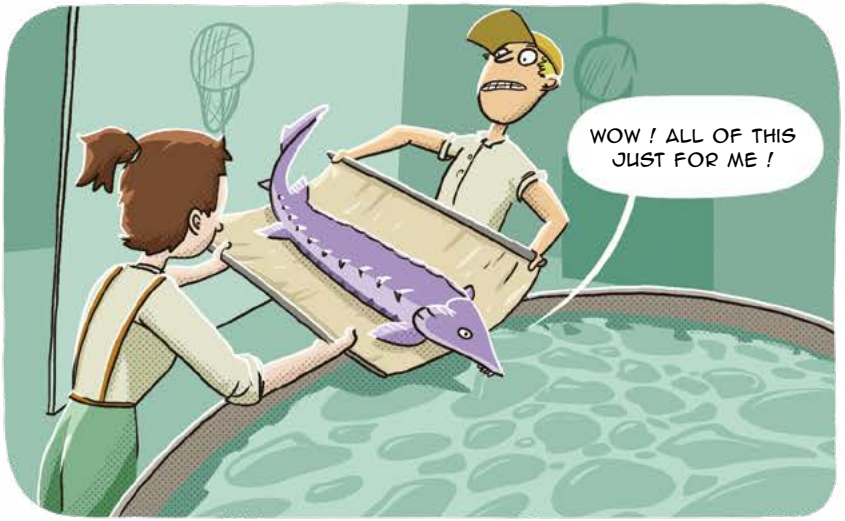
Since 1995, the conservation centre in St-Seurin sur l'Isle produces sturio larvae with artificial breeding of live captive wild sturios to prevent the species extinction. To achieve this goal, a reproduction protocol was set up.



First the sturio's gonads are scanned in order to know if they are fertile.



If they are able to breed, the fertile sturios are each given a separate basin.

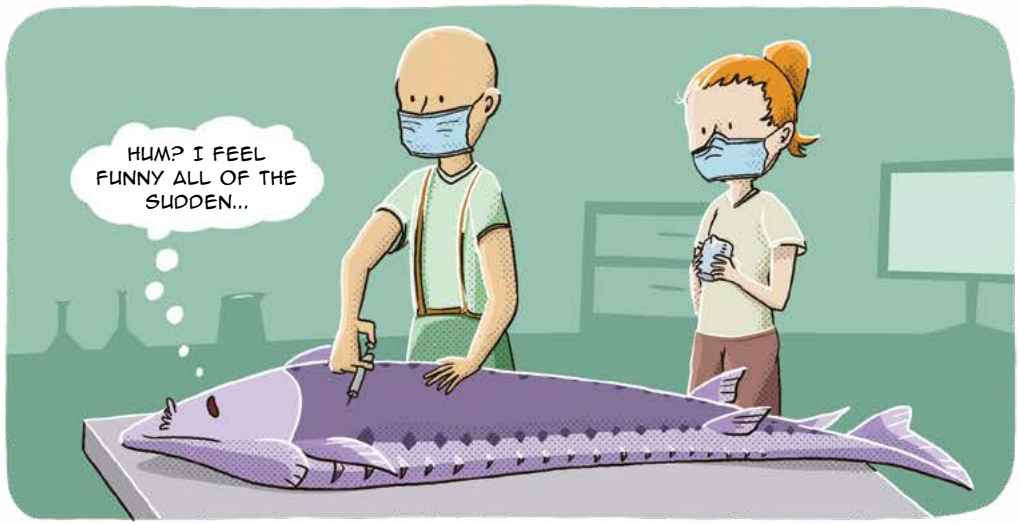


In this basin, the heat and salinity are changed to mimic the change of environment and stimulate spawning.

With the sturios ready, they are anaesthetized. A new scan confirms that the females are ready to reproduce, and if they are, their ovocytes are collected.

*a small caesarean might be necessary.

Just as the females, the males are injected with hormones to stimulate reproduction and their gametes are also collected.

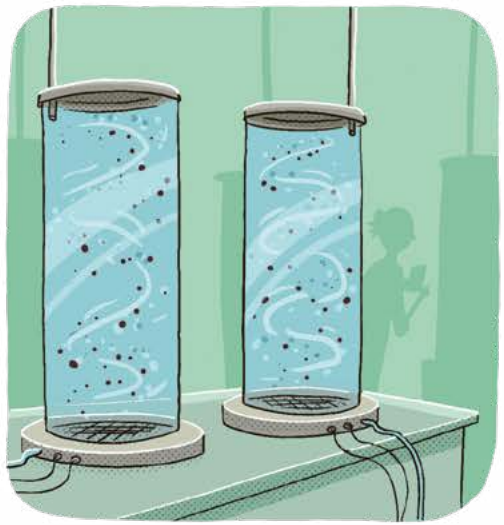


The samples are analysed to ensure their quality, viability and their origin.

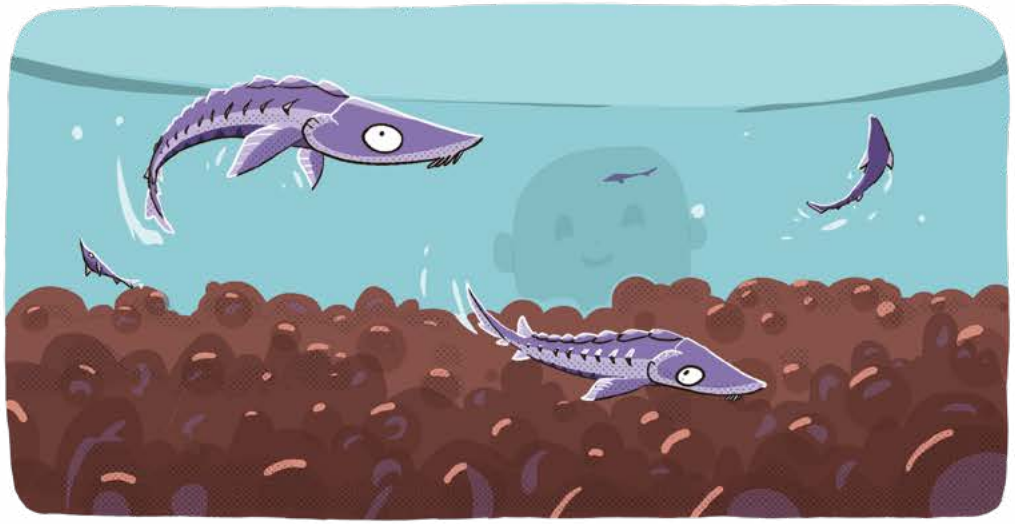
Then the gametes are mixed taking into account genetic differences to favour diversity.

Afterward, they are stirred in a clay bath to be cleaned.

...then in jars simulating their natural habitat.



The eggs hatch...



...and the larvae are evacuated to basins with overflows.

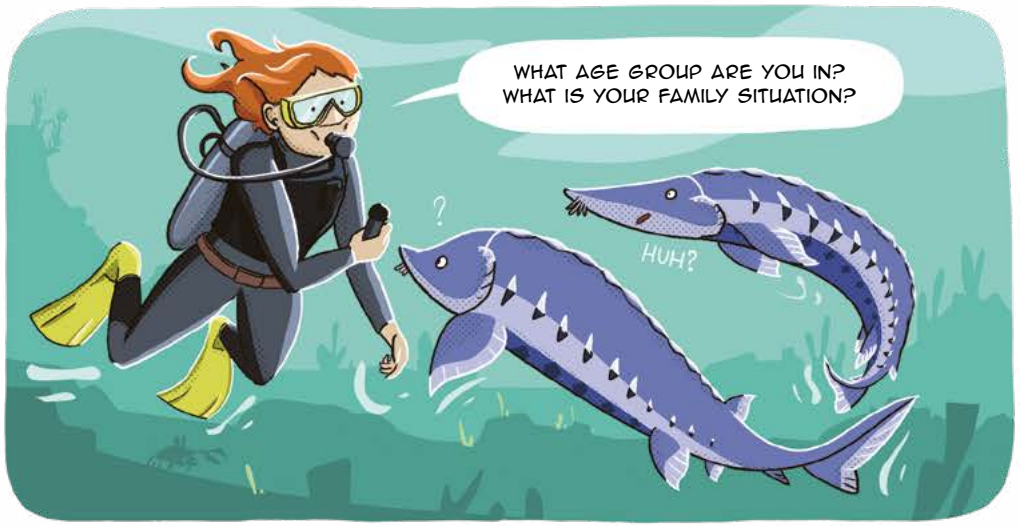
Repopulation of the rivers with juveniles is conducted thanks to the captive breeding.

In 1995, 9000 juveniles were released in the Gironde-Garonne-Dordogne basin and between 2007 and 2015 more than 1.7 million juveniles were released in the basin in France, and more than 20,000 in the Elbe basin in Germany.

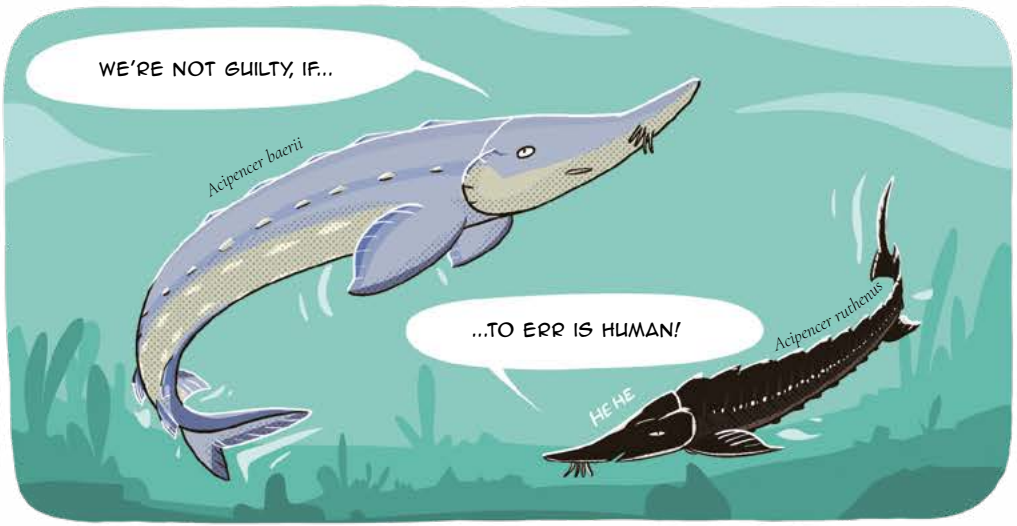
Fish reproduction quietened down for a while but they have now started again with the release of 365 individuals in 2022, and 4,200 more were released in 2023.

Collective work meetings are regularly held among the sturio's NPA stakeholders and many actions are carried out in their natural habitat to evaluate the effectiveness of repopulations and the quality of their environment.

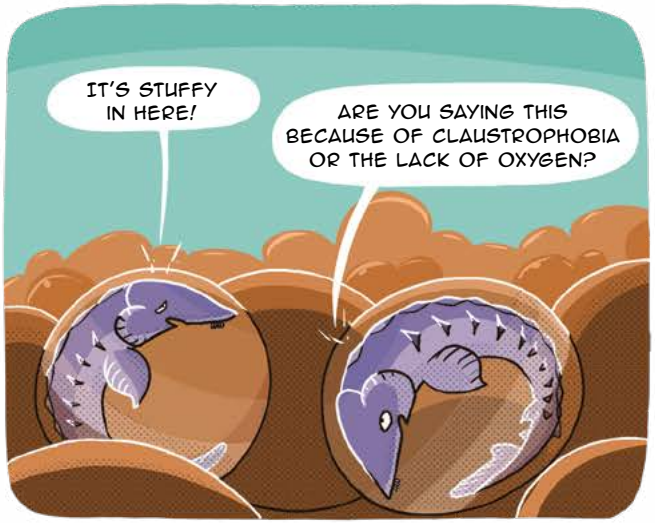
Scientists monitor the individuals that live in their natural environment.



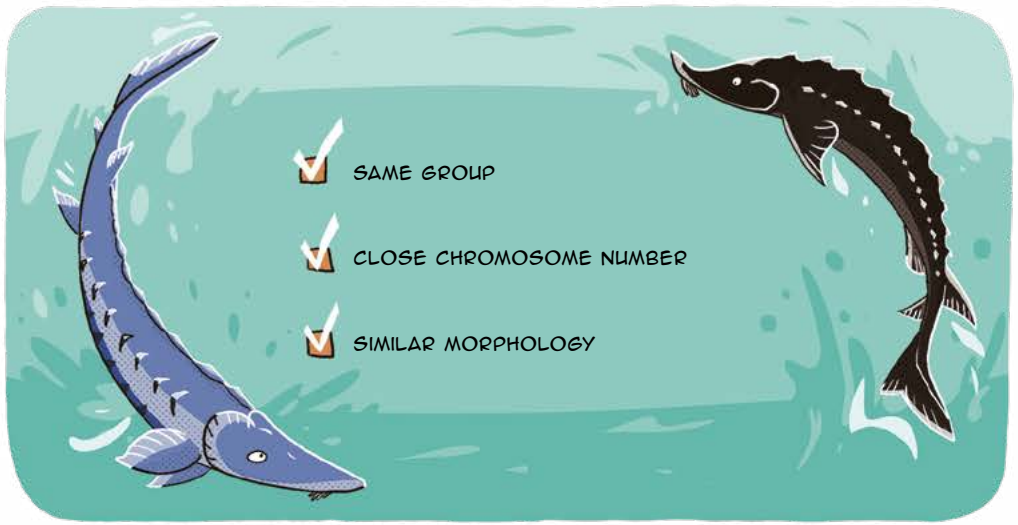
The State is tasked with preventing the introduction of different sturgeon species farmed in the Gironde basin. These other species may compete with the European sturgeon for food and habitat.



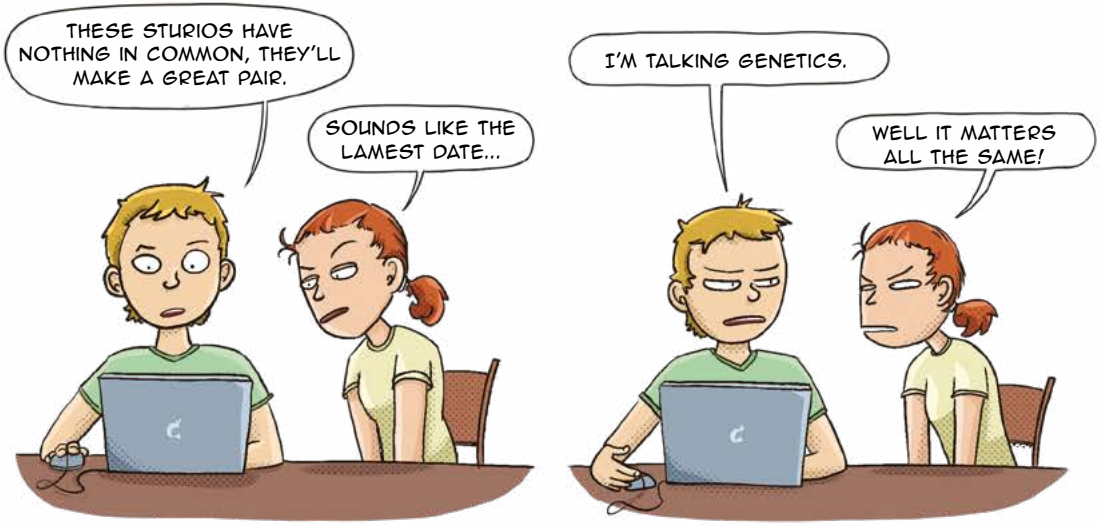
Many experiments are conducted on migratory fishes, for example oxythermal stresses (oxygen levels and environmental temperature) and the impact of pollutants on the survival of sturio embryos are studied.



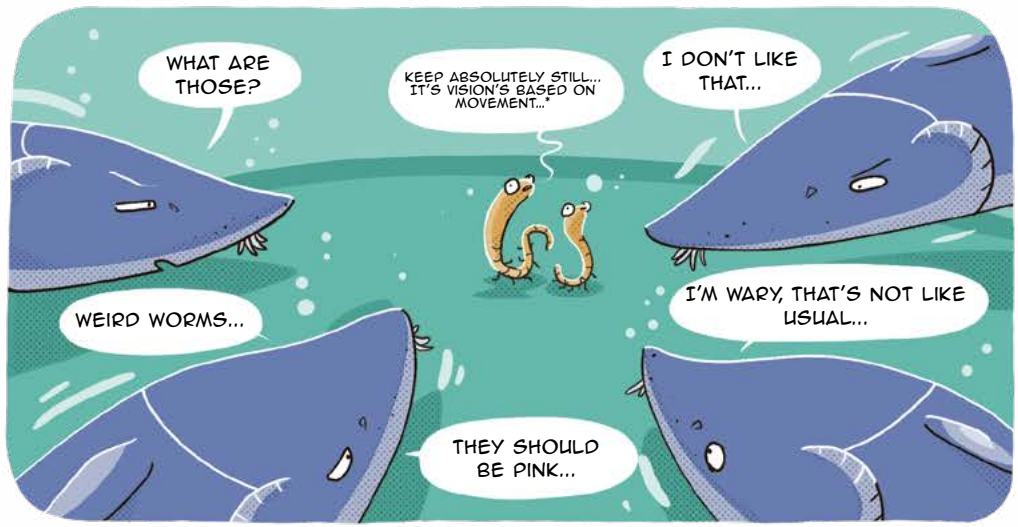
Researchers study specific aspects of reproduction, of which the quality of seeds and their cryopreservation. For this task, a different sturgeon species is used jointly: Acipenser ruthenus.



Biologists have developed technics and tools, for example a "stud-book" corresponding to genetic clues that allow the optimisation of breeding by taking the fishes lineage and genetic diversity into account in order to favour the latter.

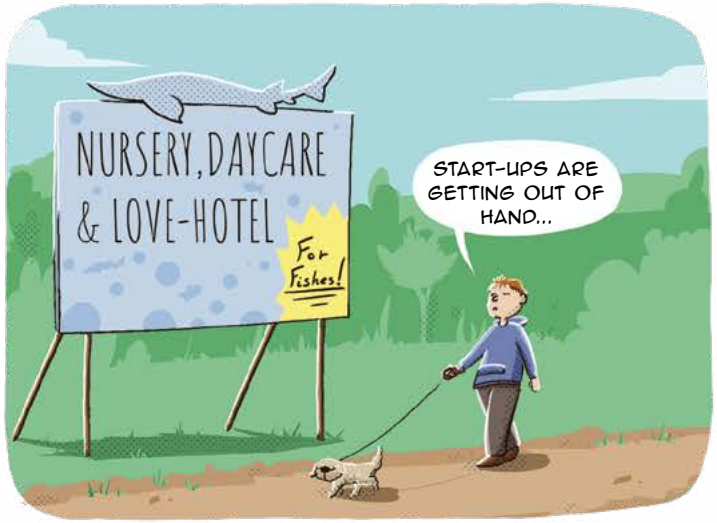


Experiments are conducted to refine conservation breeding methods to improve survival after release in their natural habitat. For example, the holding facilities are enriched with live prey to stimulate cognitive abilities in sturios to forage and prepare them for their natural environment.



*This quote is not scientifically accurate.

Currently, there are 200 to 300 individuals mainly born in captivity that serve as the broodstock at the station. After each reproduction most of the individuals are released to the wild.



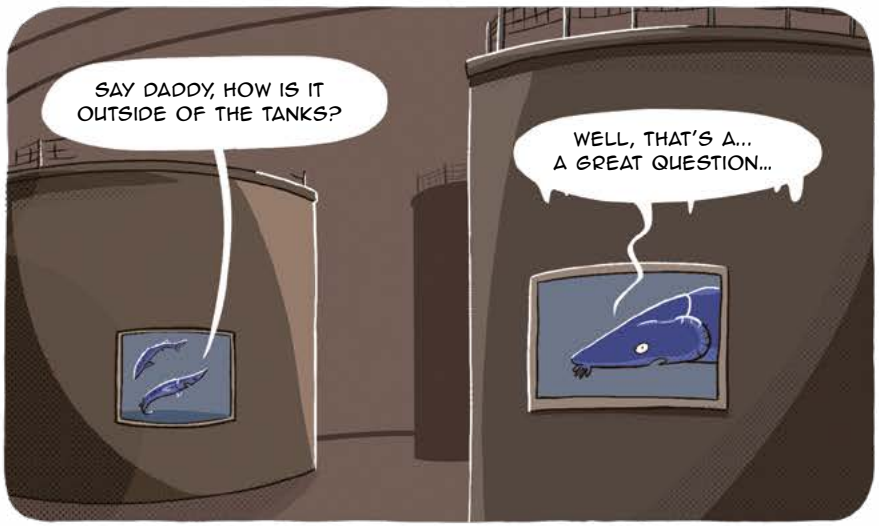
Between 2007 and 2014, larvae were released at different life stages (around 7 days after birth, 3 months, 1 year and more).

By releasing at different stages, it manages the level of risk. The older larvae will have a better chance at survival but their longer time spent in nursery leaves them less suited to their environment, whilst the younger larvae have higher chances to die, but they will more easily adapt to their surroundings and develop accordingly.

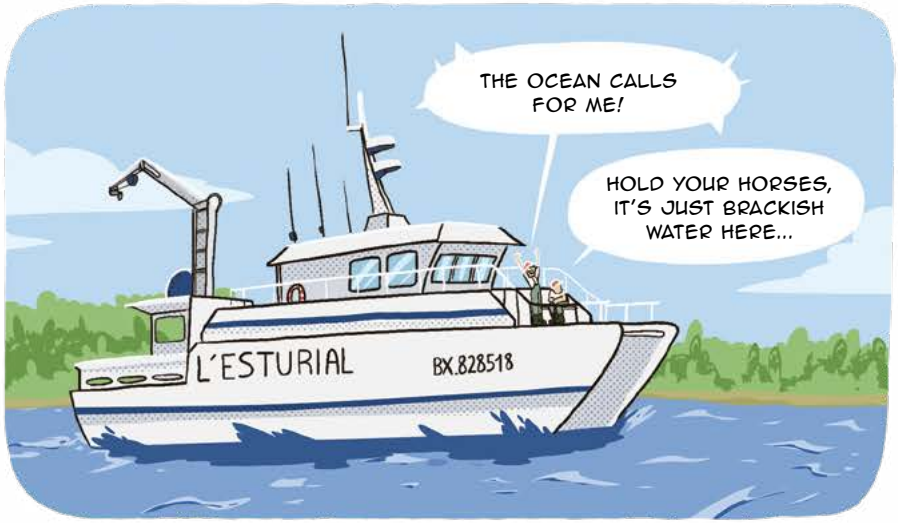
In 2022, the first *in situ* reproduction of individuals born in captivity was recorded.

The goal of these releases near potential spawning grounds is to start a new population in their natural habitat.

Thanks to the release plans, it will be possible to identify which were the parents of the individuals (and therefore their genetic background) once they return to fray to the Garonne-Dordogne basin, as well as identify their release state in order to develop the restoration protocols in the coming years.



In order to keep track of sturios and other fishes in the estuary, researchers these days employ a catamaran dedicated to scientific fisheries, sampling and measurements.

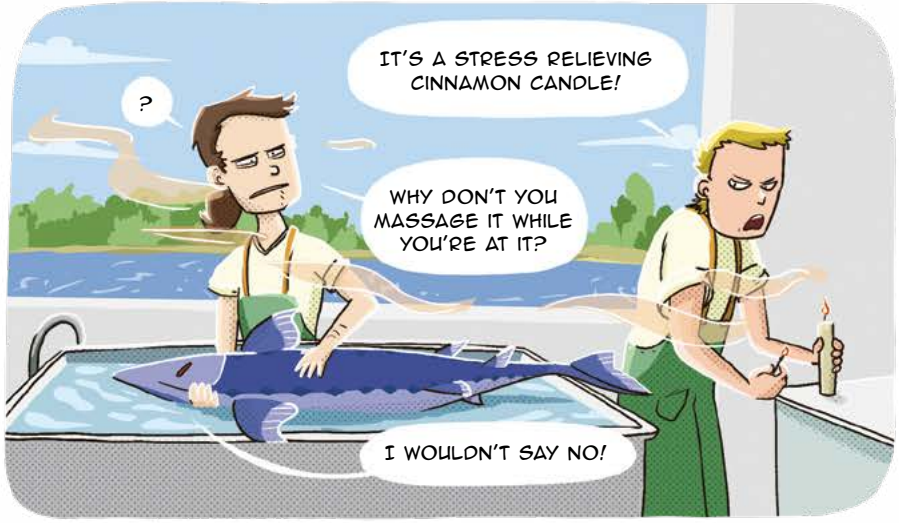


Twenty fishing hauls of 30 minutes each are performed in the estuary every two months in order to do species related biological records.

Every species caught are counted and a small sample of 30 individuals of each species is measured.

The fishes are handled in water and quickly released to limit the impact of these practices.

Biologists embarked on these missions are trained for animal experimentation and every manipulation is done in a way that respects the animal's well being.



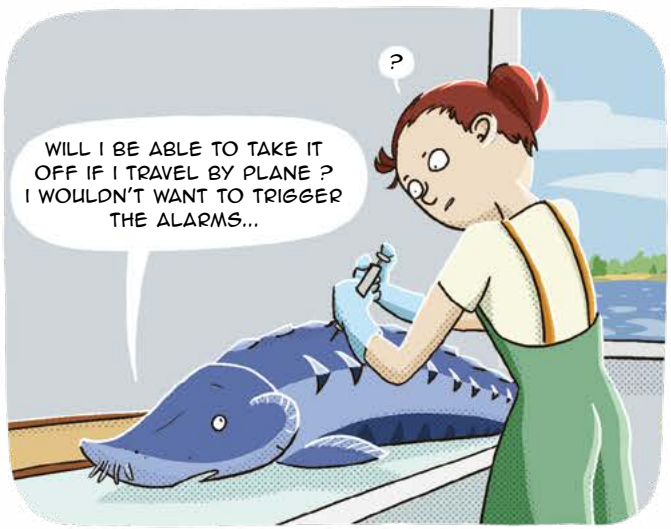
When a sturio is caught, it is anaesthetized,

wheighed,

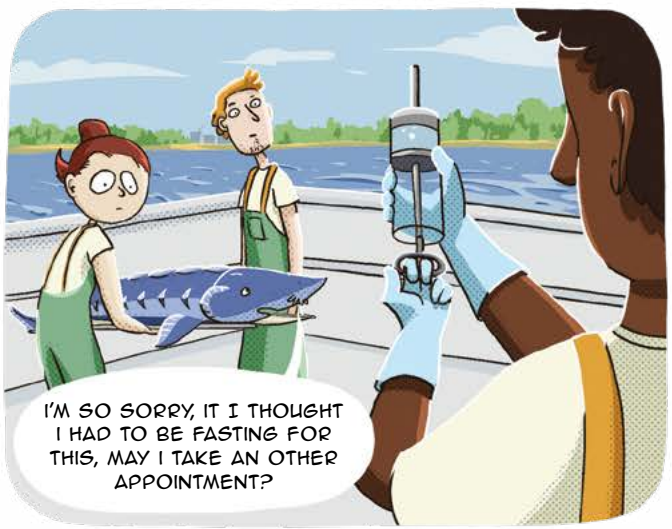
mesured,

photographed,

and marked.

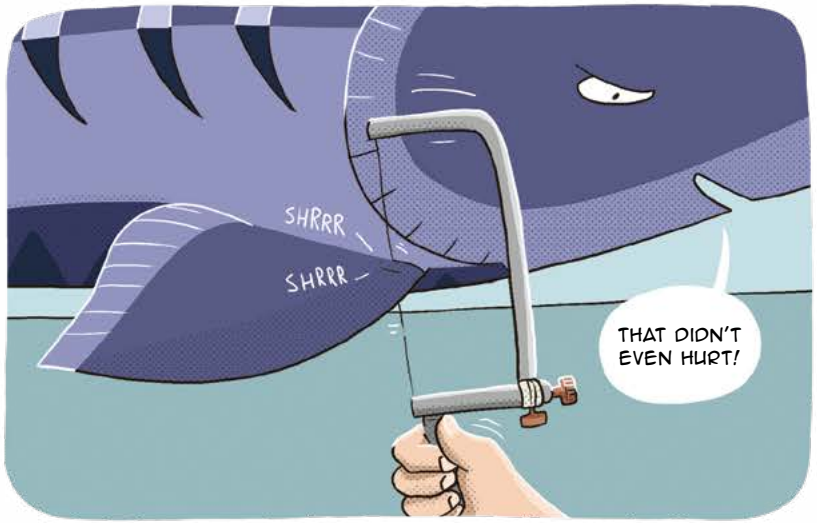


In order to study their diet, sturios undergo a gastric lavage, we mainly find worms (polychaeta) and small crustaceans.



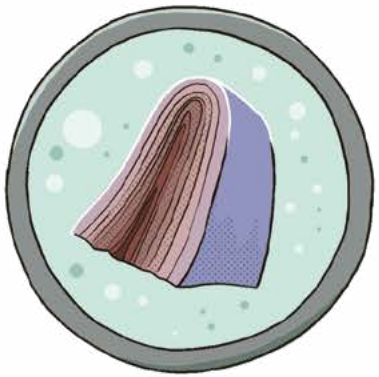
They are finally awakened and they slide back in the water.

Among the samples taken by the research ship, biologists puncture a small piece of cartilage from the pectoral fins.



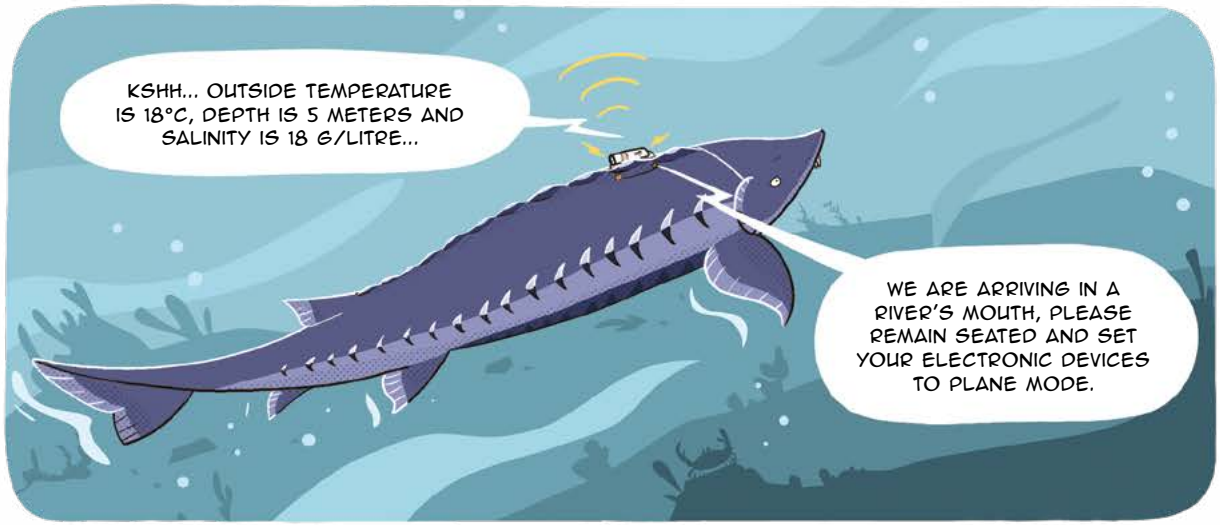
The age of other fishes can be read on their scales, but sturgeons only have skin.

We can even see with a naked eye the marks in the shape of rays that form over time on the cartilage, the same way we can see rays in tree trunks.



On other non-cartilaginous fishes, we collect their otoliths, some kind of a little rock located in their inner ear that helps them with balancing and hearing.

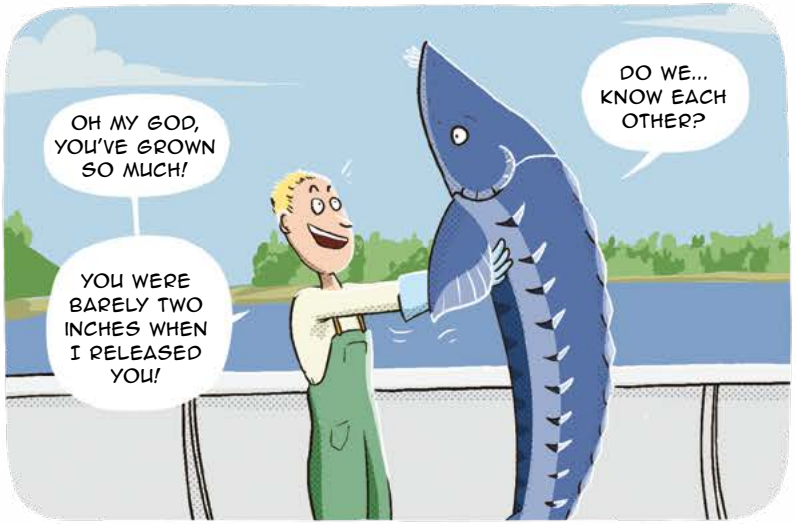
In a way, biologists are collecting their black box. Analysis of marks found on scales and otoliths and their microchemistry reveals information on the fish habitat. The installation of various electronic markers allows to register the living conditions of the fishes (temperature, depth, salinity and more).



In addition to the piece of cartilage, biologists also puncture a small sample from a fin.

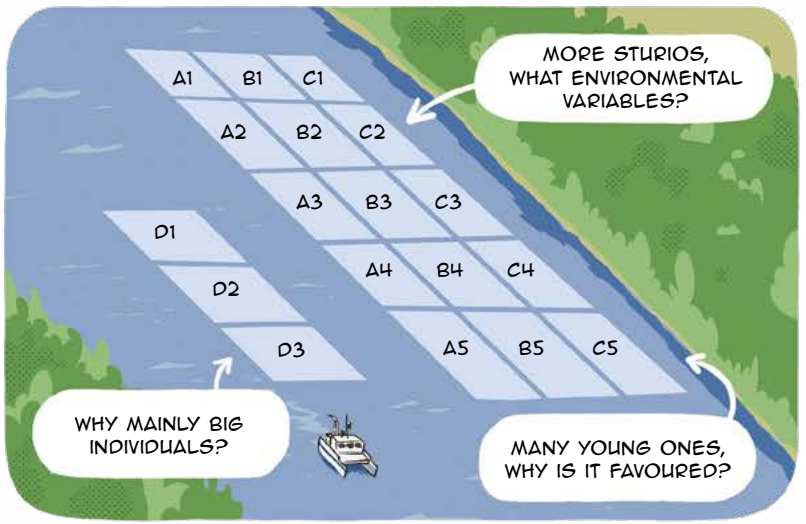
Biological analyses of organic pieces reveal the kinship of the sturios, but also their release site.

It's thanks to biological samples that we can estimate the health of a population in their environment and observe if sturios born in captivity do return to the "spawning ground" they were released at.



Sturio monitoring campaigns also allow a monitoring of other fish populations in the estuary. Migratory species are also closely monitored because they often fall victim to the same threats as sturios.

These samples make it possible, for example, to study the preferred habitats of the sturios in the estuary by studying environmental settings using a virtual mesh of the estuary.



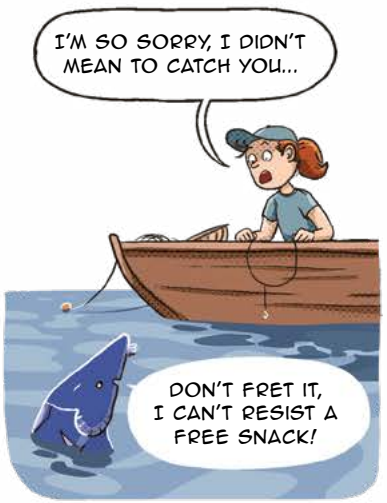
All these data are compiled to give the number and size of sturios caught, and it allows the deduction of what environment sturios of a specific age prefer.

At this time, the efforts invested to save the species since the beginning are starting to give encouraging results, scientific fisheries and professional fishermen report that big specimens of sturios are returning to the estuary.

Fishermen have spotted big sturios in the rivers since 2020 in the Dordogne and the Garonne River as well as in the Elbe.

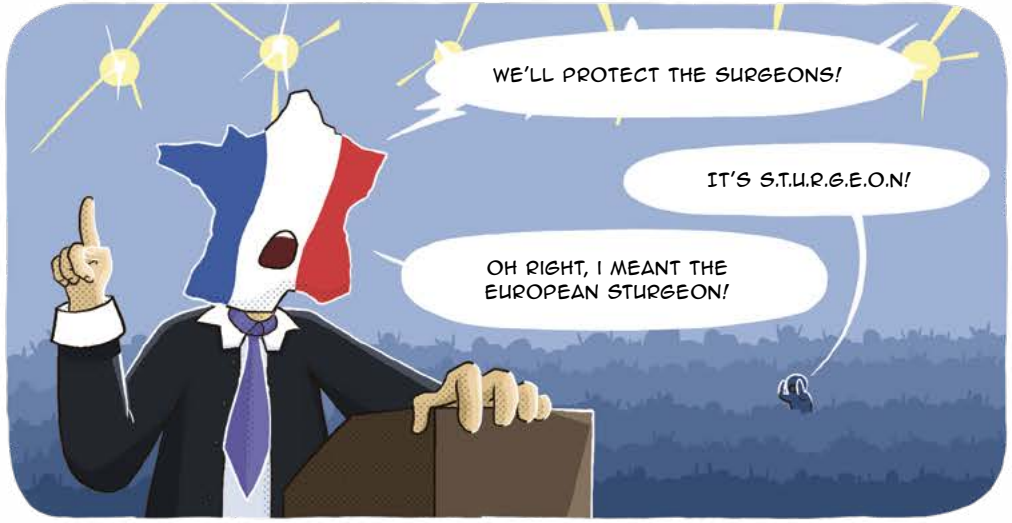
Accidental observation reports by fishermen and citizens are precious indicators of the impacts of the efforts given for the restauration of the species.

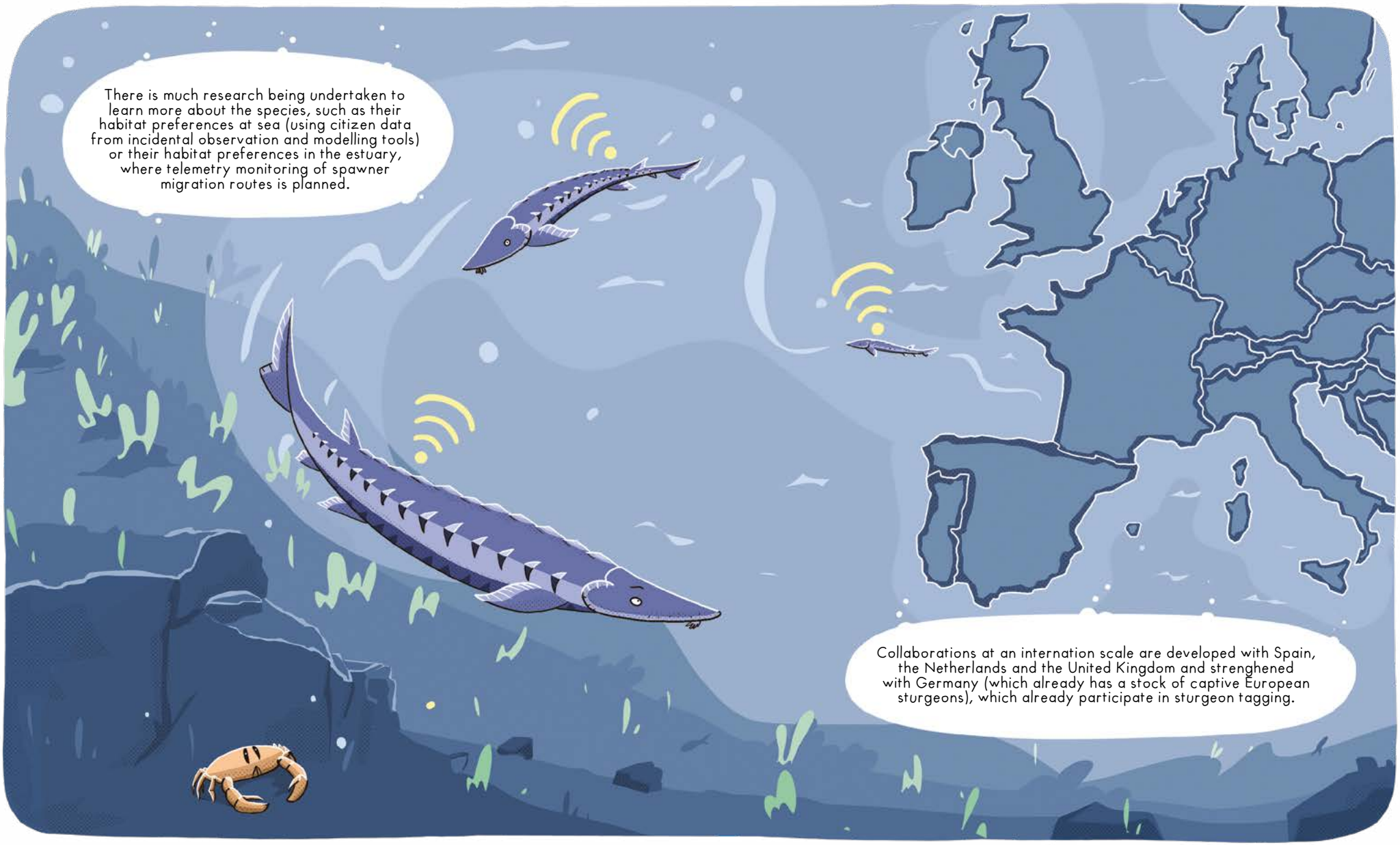
By the way, sturgeons are fishes that are rather resilient and resist fairly well to accidental catches if they are released quickly.



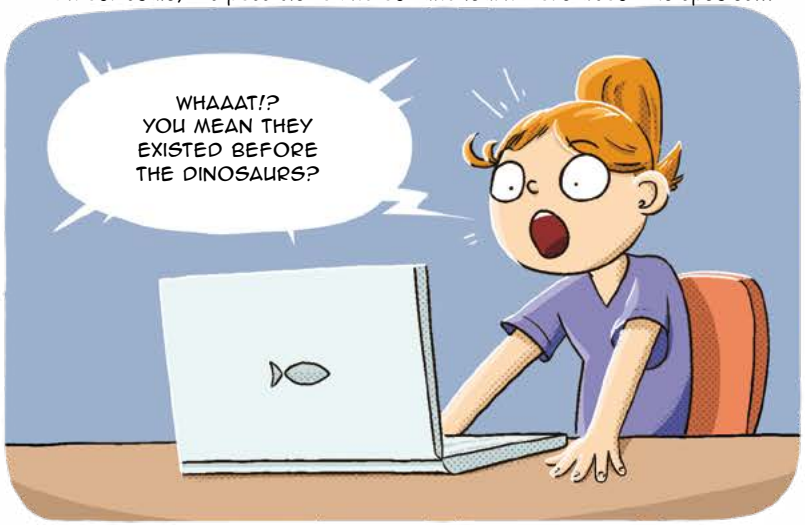
Thanks to these encouraging results, the NPA was renewed between 2020 and 2029, coordinated by the State and lead by an association for the protection of migratory fish.

France is committed under the Berne Convention to the conservation of wildlife in Europe, including the protection of sturios in their natural environment and their habitat.




There is much research being undertaken to learn more about the species, such as their habitat preferences at sea (using citizen data from incidental observation and modelling tools) or their habitat preferences in the estuary, where telemetry monitoring of spawner migration routes is planned.
Collaborations at an internation scale are developed with Spain, the Netherlands and the United Kingdom and strenghened with Germany (which already has a stock of captive European sturgeons), which already participate in sturgeon tagging.

On our scale, it's possible to find out and learn more about the species...



...measure the individuals and report catches and observations on the « sturio.fr » website...

...Preserve the sturio's natural habitat by not polluting or wasting fresh water...

...And finally share this comic with those around you to raise awareness among as many people as possible.

The European sturgeon is a species whose extinction has been postponed for the time being, but now we are all responsible for its future.

WHO ARE THE STAKEHOLDERS IN STURIO CONSERVATION?

Stakeholders of the current NPA hidden behind "the State", "scientists", "fishermen" ,"association for the protection of migratory fish" are real entities that evolved over time (change of name or mission, gradual arrival of certain actors over time).

Behind the "State" is the DREAL (Regional Directorate for the Environment, Planning and Housing) which has been coordinating the sturio PNA since 2011;

Behind the "scientists" are INRAE (the French National Research Institute for Agriculture, Food, and the Environment), which has been conducting research and monitoring the species since the 1980s, both in captivity and in the wild;

Behind the "fishermen" are the CNPMEM (National Committee for Maritime Fisheries and Marine Farming), the regional committees, and CAPENA (Centre for Aquaculture, Fisheries, and the Environment of Nouvelle-Aquitaine), which have been raising awareness among professionals and collecting information on accidental captures since 2007;

Behind the "migratory fishes protection associations" are MIGADO (Migrateurs Garonne Dordogne Charente Seudre), which has been leading the PNA since 2011 and has gradually taken over from INRAE for ex-situ aspects such as captive stock conservation, restocking operations, and assisted reproduction.

This isn't an exhaustive list, many more actors played and will play a role in the preservation of this species!

This comic's aim was to raise awareness and inform the widest public by specifically popularizing scientific research.

SOURCES

References :

Adam G., Lavronce V., Rochard E., Acolas M.L., Souben J., Tesseyre D., Valadou B., Chaumel A., Bernard C., Guerii O., 2020. Plan national d'actions 2020-2029 En faveur de l'esturgeon européen *Acipenser sturio*. Ministère de la transition écologique et solidaire. Association MIGADO, INRAe, CNPMEM, DREAL, 79 p.

Lamour M., Le Barh R., Merg M.L., Grasso F., Quinton E., Rochard E., Le Pichon C., Acolas M.L., 2024. Using simulated environmental variables to assess the seasonal estuarine habitat selection of a critically endangered anadromous species (Acipenser sturio). Estuarine, Coastal and Shelf Science 298: 108656.

Nuremberg J-B., 2020. Une espèce sous haute protection : l'esturgeon européen. La pêche et les poissons n°897, p 80-82.

Lamour M., Le Barh R., Merg M.L., Grasso F., Quinton E., Rochard E., Le Pichon C., Acolas M.L. 2024. Using simulated environmental variables to assess the seasonal estuarine habitat selection of a critically endangered anadromous species (*Acipenser sturio*). Estuarine, Coastal and Shelf Science 298: 108656.

Acolas M.-L., Le Pichon C., Rochard E., 2017. Spring habitat use by stocked one year old European sturgeon *Acipenser sturio* in the freshwater-oligohaline area of the Gironde estuary. Estuarine, Coastal and Shelf Science, 196, 58-69.

Ephrem B., 2017. Des restes d'esturgeon à Ecorneboeuf : un marqueur social chez les Pétrocores ? ADRAHP, Documents d'archéologie et d'histoire périgourdines, Suppl. 7, p 375-382.

Carrera Garcia E., Rochard E., Acolas M.-L., 2016. European sturgeon (*Acipenser sturio* L.) young of the year performance in different rearing environments: study within a stocking program. Environmental Biology of Fishes, 99 (11), 887-901

Jatteau P., 2015. Programme de recherche et de conservation de l'esturgeon européen *Acipenser sturio* : Bilan scientifique et technique 2014. IRSTEA 133 p.

Lassalle G., Crouzet P., GessnerJ., Rochard E., 2010. Global warming impacts and conservation responses for the critically endangered European Atlantic sturgeon. Biological Conservation, 143, p 2441-2452

Quel avenir pour l'esturgeon européen ? 2002. EPIDOR. Actes de séminaire, Libourne, 181 p.

Rochard E.,2002. Restauration de l'esturgeon européen *Acipenser sturio*. Rapport scientifique contrat LIFE n°B-3200/98/460. Etude Cemagref n°80, groupement de Bordeaux.

Jego S., Gazeau C., Jatteau P., Elie P., Rochard E., 2002. Les frayères potentielles de l'esturgeon européen *Acipenser Sturio* L. 1758 dans le bassin Garonne-Dordogne. Méthodesd'investigation, état actuel et perspectives. Bulletin Français de la Pêche et de la Pisciculture, no 365-366: 487-505.

Brosse L., Lepage M., Rochard E., 2000. Premiers résultats sur l'alimentation de l'esturgeon européen, *Acipenser sturio*, dans l'estuaire de la Gironde. Comparaison avec la faune benthique. Société Française d'Ichtyologie, p 49-61.

Coelho M.M., Collares-Pereira M.J., Cowx I.G., 2000. Conservation of freshwater Fishes : Options for the future. Blackwell Science-Fishing news books, chpt 14, p 142-148.

Pustelnik G. et Guerri O., 1999. Analysis of partnership and conservation requirements for a threatened species, *Acipenser sturio* L., 1758 : Towards the implementation of a recovery plan. Bol. Inst. Esp. Oceanogr. 16 (1-4), p 209-216.

Elie P.,1997. Restauration de l'esturgeon européen *Acipenser sturio*. Contrat Life rapport final du programme d'exécution. Bordeaux: Cemagref de Bordeaux.

Pustelnik G., Guerri O., Vignaud E., 1995. La disparition de l'esturgeon européen dans les bassins de la Garonne et de la Dordogne - Les mémoires d'un garde pêche. EPTB Dordogne, 48 p

"Naissance de la Vie - une lecture de l'art pariétal" Michel Lorblanchet, 2020, éditions du Rouergue

Conference :

Conférence de l'université de Montpellier "Comme un poisson dans l'art: art et biodiversité aquatique du passé" par Daniel Faget, Thomas Changeux et Anne-Sophie Tribot, 2024.

Videos :

Plan national d'actions #5 - Film sur le lâcher d'Esturgeons européens (Acipenser sturio)

Décimé pour son caviar, ce poisson géant bientôt sauvé en France ?

LES DERNIERS ESTURGEONS SAUVAGES

Étonnante découverte : un esturgeon européen (Acipenser sturio) d'1,1m et 6 kilos a été observé par l'Université de Saint-Jacques de Compostelle.

Web sources (excluding the dozen of Wikipedia pages I ended up searching) :

sturio.fr

migado.fr

ospar.org

coe.int

iucnredlist.org

migrateursrhonemediterranee.org

eptb-dordogne.fr

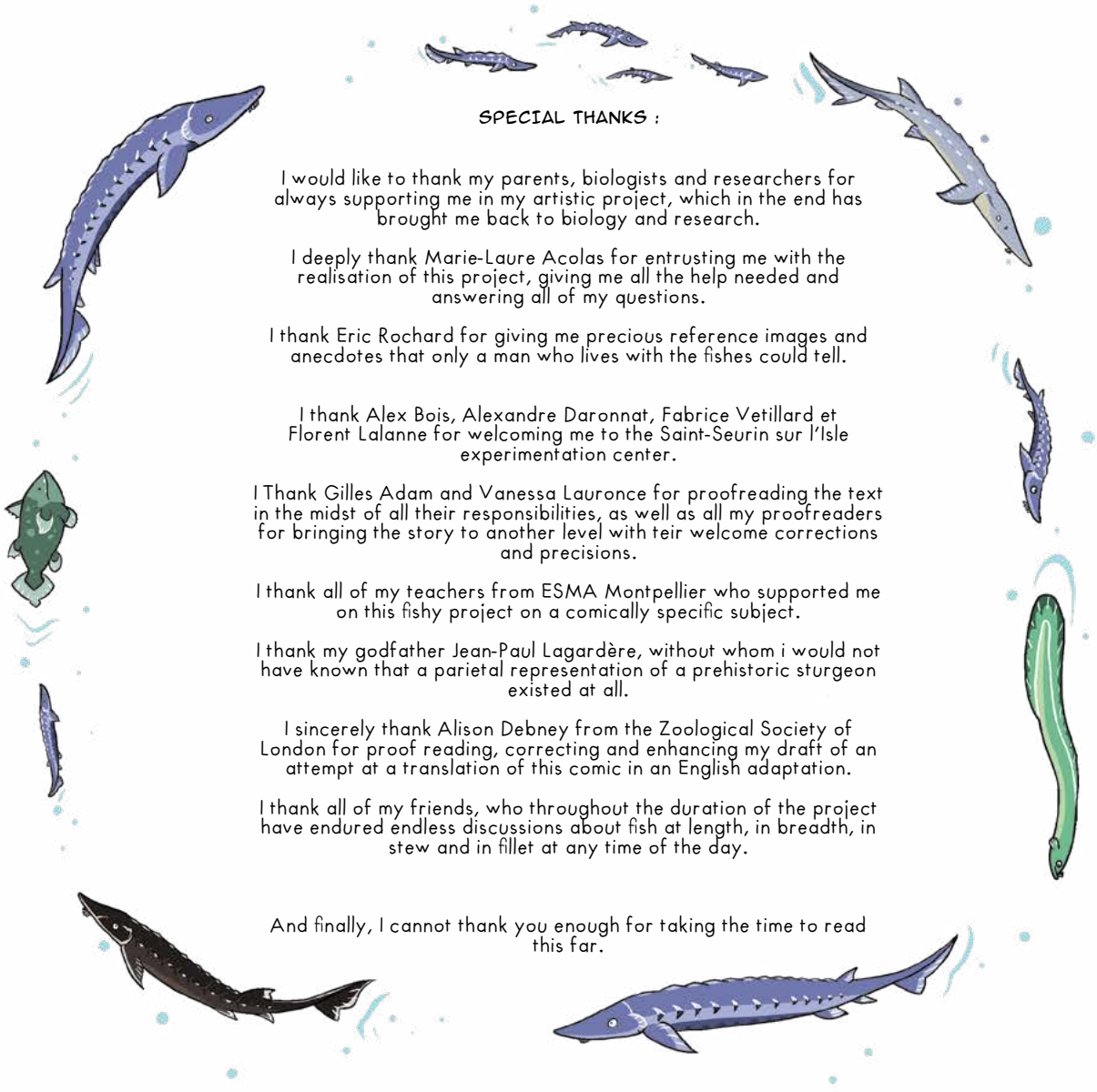
futura-sciences.com

kaviari.fr

aurea-ova.com

espritdepays.com

eabx.bordeaux-aquitaine.hub.inrae.fr



SPECIAL THANKS :

I would like to thank my parents, biologists and researchers for always supporting me in my artistic project, which in the end has brought me back to biology and research.

I deeply thank Marie-Laure Acolas for entrusting me with the realisation of this project, giving me all the help needed and answering all of my questions.

I thank Eric Rochard for giving me precious reference images and anecdotes that only a man who lives with the fishes could tell.

I thank Alex Bois, Alexandre Daronnat, Fabrice Vetillard et Florent Lalanne for welcoming me to the Saint-Seurin sur l'Isle experimentation center.

I Thank Gilles Adam and Vanessa Lauronce for proofreading the text in the midst of all their responsibilities, as well as all my proofreaders for bringing the story to another level with teir welcome corrections and precisions.

I thank all of my teachers from ESMA Montpellier who supported me on this fishy project on a comically specific subject.

I thank my godfather Jean-Paul Lagardère, without whom i would not have known that a parietal representation of a prehistoric sturgeon existed at all.

I sincerely thank Alison Debney from the Zoological Society of London for proof reading, correcting and enhancing my draft of an attempt at a translation of this comic in an English adaptation.

I thank all of my friends, who throughout the duration of the project have endured endless discussions about fish at length, in breadth, in stew and in fillet at any time of the day.

And finally, I cannot thank you enough for taking the time to read this far.


How does one do to reintroduce a species brought
to the brink of extinction by humankind?
Well, it's tough! Come on, put on a wetsuit,
and dive with the sturgeon!