BioS Reports

glimpse into the activities of the Master's course „Biology in Society"

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ANIMALS AND MONEY

This part of BioSReports unravels interesting relations between animals and the economy.

Consumerism is driving the European eel to extinction

by Charlotte Kricke

Fishery is a primary industry worldwide. However, commercial fishing and overfishing are driving many aquatic species toward extinction by interfering with population life cycles[1], meaning they cannot reproduce. Especially the European eel (*Anguilla anguilla*) is "critically endangered"[2,3], since it has a survival rate of 10% in nature[4] yet is also being traded in large amounts internationally at high prices[5]. Regulations have been put in place to protect and recover the critically endangered European eel populations[2,4].

The European eel has a complex life cycle (see figure), traveling 5000 to 6000 km from inland fresh water to the ocean during their lifetime to spawn. Eels live as yellow eels in freshwater until reaching sexual maturity[7]. They change from yellow to silver eels before they migrate to their mating area in the Saragasso Sea[8]. The hatched larvae reach Europe and Africa coastal waters by Gulf Stream[7,8]. Upon reaching the continental shelf, they metamorphose from larvae to glass eels, with most completing their migration to continental waters as pigmented yellow eels[4,7].

Due to this complex lifecycle, eel farming is based on lower effort wild catches of glass eels. While various fisheries of *A.anguilla* exist in Europe, the largest producers are based in Asia[7,9].Since individual glass eels are quite small, the sold amount is measured by weight. One kg of glass eel consists of about 3,500 individuals, meaning that 1000 tons are equivalent to 3,5 billion individuals[10]. In 2019, around 4000 tons of *A.anguilla* (live weight, all life stages) were caught in the wild, three times less than in 1980. At the same time, around 5000 tons of eels were produced in aquaculture in 2019[11].

In 2018, the estimated value of a processed fillet at consumer level in Europe was 60 €/kg, considerably higher than other fish (e.g., Atlantic salmon ~15.00€/kg)[10,12]. From this it has been calculated that the economic turnover generated from the eel market at consumer level is between €59 million and €711 million annually for raw fillet and between €188 million and €2.27 billion for processed fillet[10]. However, the market prices differ across countries within Europe. Besides regulations to protect the European eel, import and export of European eels from the EU have been prohibited since 2010[4]. However, despite export ban from the EU, high demands in Japan and China drive up prices of fish and cause illegal exports. In 2015-17 about 30 tons (~50%), of the reported European catches of European eel were untraceable but were likely traded to East Asia[10]. Europol estimated

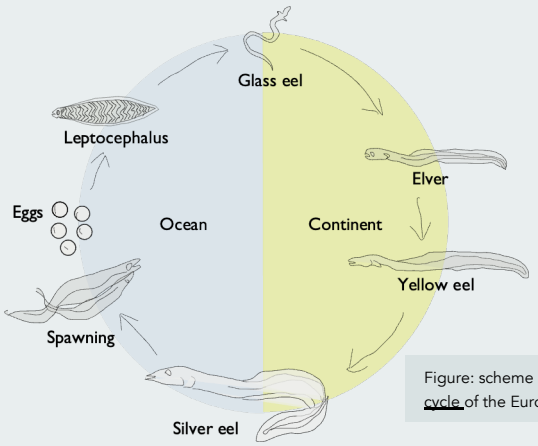

Figure: scheme of life cycle of the European eel

that 100 tons of eels have been smuggled to supply Chinese eel farms[13]. That would be the equivalent of 350 million glass eels, or €625 million. There is a lot of illegal trade and available data is partly unreliable due to thus unlisted catch figures. Glass eel resources are the bottleneck in the development of the eel industry[5]. At the same time, eels are very susceptible to overfishing[2]. Since demand is much higher than reported supply, high profits fuel the black market, which makes European protection measures almost impossible. The huge scale and persistence of illegal trade - potentially three times the size of the legal market! - not only has a massive human impact on the stock but also undermines the credibility of European eel conservation plans[10].

In conclusion, reducing demand would be key to protecting European eels and the balance of the ecosystem. A general ban on eel fishing could result in a poorer image of the eel trade and consumption and, in combination with educational campaigns, reduce demand. Furthermore, consistent prosecution of illegal trafficking is required. It is up to future decisions and precautions to protect this unique species and not let it fall victim to the consumerism of humanity.

EXCURSIONS AND OTHER NEWS

Small insights in student's or professor's points of view, field trips, and other stuff.

Siamese Twin Fish - Lab Rotation

by Kajol Bajaj

I did a lab rotation under Alexander Froschauer in the research group Environmental Monitoring and Endocrinology, using the medaka, commonly known as the Japanese rice fish. In medaka (*Oryzias latipes*), high instances of monozygotic conjoined twinning, meaning twins that are physically connected to each other, were seen previously. Further research in medaka could help to find genetic reasons for conjoined twinning and improve our understandings of the embryonic developmental process in vertebrates in general.

Therefore, the topic of my lab rotation was to physically observe individual eggs using the microscope and genetically test abnormally developing medaka eggs. I could then compare how normal and abnormal eggs differ both optically and genetically. Besides microscopy work I performed PCR tests and analyzed DNA. The lab rotation helped deepen my experience and improve my abilities in laboratory practices, so I found the whole lab rotation overall to be very interesting and informative.

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ANIMALS AND MONEY

Eurasian jays can save the EU up to 216 billion USD annually

by Elisa Peters

Trees have a large positive impact on reducing the CO_2 level of the world. Trees control ground erosion, especially in headwater regions[1,2] and there are indications that trees have positive aspects on human health.[3] In European forests, oaks are among the most common species.[2] The maintenance of biodiversity of European forests greatly depends on various bird species. For oak trees, this is the Eurasian jay *Garrulus glandarius*[4], that occurs in Europe and Asia. The bird lives in the dense foliage of the forests.[5] Aside from its main food source acorns, the Eurasian jay also eats beechnuts and unripe hazelnuts. The Eurasian jay buries collected acorns as an all-year food supply. However, it is estimated that the bird forgets about more than 60% of its hidden seeds, from which new oaks can grow.[6,7,8,9] This article addresses the economic benefits of natural oak rejuvenation all over Europe by Eurasian jays, compared to rejuvenation of oaks by humans.

Eurasian jays can display either short- or long-time storage of food. Food stored short-term is meant to be instantly available and is therefore not buried as deep as food stored long-term.[8] Especially the long-time stored seeds are the basis of new oak trees because they are often forgotten over the winter months. Not only the time of storage is important, but also the quality of acorns is considered. Bigger acorns often are stored long-term, while smaller acorns are directly consumed. The Eurasian jay also preferentially collects ripe and healthy acorns. With the acorns deeply buried under the earth in specifically selected bright hiding places, oak seedlings face optimal growing conditions.[2]Eurasian jays do not re-use hiding places, meaning the area where acorns can be buried and oak trees will grow expands.[7] Also, if a jay is observed by other jays while hiding acorns, it will hide its catch further away than if it is unobserved.[10] This will facilitate the long-term dispersal of oaks. A single jay can hide up to 11,000 acorns per year[11], of which 60% (6,930 seeds) would not be eaten. 50% of these hidden seeds (~ 3,465) could grow to oaks annually[8]. In 2015 in Europe 15 million-29.3 million Eurasian jays were counted.[12] Accordingly, every year around 52 - 102 billion oak trees are planted by these birds in Europe. For the Area of the Stockholm National City Park, it was estimated that oak rejuvenation performed by humans instead of jays would cost $2,100 to $9,500 per ha per year.[8] In the Stockholm national park 84 jays were counted, and a similar number of jays are estimated to occupy Europe's oak forests. Of Europe´s 227 million ha forest, in 2020 around 10% of forest was oak forest area.[2] If oak rejuvenation of these 22.7 million ha was performed by humans instead of Eurasion jays, it would cost US$47.7 billion up to US$215.7 billion per year. A single jay that lives up to 16 years[13] is worth $400 to US$1,808 only in the perspective of planting new oak trees.

jays can preserve the European oak forests by spreading and burying oak seeds, in a larger area and in less time than humans would need.[8] In Europe, oak rejuvenation as a by-product of foraging performed by jays instead of humans saves $47.7 billion to $215.7 billion every year.[8]Annual forest losses in Europe increased in the years 2016 to 2018.[14] If human-caused deforestation continues this way, jays will unlikely be able to maintain the oak population in Europe themselves. Oaks are essential for the survival of Eurasian jays. If the oak population declines, Eurasian jays themselves may be threatened. This analysis of the economic importance of Eurasian jays in European oak forests can be applied to almost every forest in the world, since animals are contributing to forest maintenance in many areas in the world. This statement also shows an additional detrimental consequence of deforestation that has barely been considered in recent years: the destruction of forests also destroys their self-regeneration potential.