CEPHALOPOD WELFARE AND LAWS IN INDUSTRIAL AQUACULTURE: EXPLORING THE IRRELEVANCE OF OCTOPUS FARMING PROJECTS

BIENESTAR Y LEGISLACIÓN DE LOS CEFALÓPODOS EN LA ACUICULTURA INDUSTRIAL: EXPLORACIÓN DE LA IRRELEVANCIA DE LOS PROYECTOS DE CRÍA DE PULPO

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ABSTRACT

According to experts, octopuses are highly intelligent and sensitive beings, capable of experiencing a wide range of emotions such as pleasure, pain and distress. Originally consumed in the Mediterranean and Southeast Asia, octopus is now increasingly sought after in new parts of the world. These animals with extraordinary cognitive abilities re now the subject of large-scale aquaculture projects, such as the one supported by the Spanish company Nueva Pescanova. Given the numerous ethical, economic, and legal issues raised by these projects, a pragmatic study of their relevance seems crucial. Particularly, the lack of legal provisions regulating the breeding of these invertebrates poses a real threat to industry's respect for their welfare. Indeed, the absence of legal provisions or best practice guidelines regulating the farming of these invertebrates is a real threat to the respect of their well-being. That being said, an analysis of existing regulations on aquaculture suggests that, in any given case, octopus farms will not be able to respect the complex physiological needs of these animals. Moreover, the development of such farms constitutes a danger to the marine environment and a serious obstacle to the implementation of environmental protection norms. Finally, commercial models based on intensive octopus farming tend to be not economically viable and will inevitably fail to comply with animal welfare and environmental protection legal requirements.

KEYWORDS

Octopus; invertebrates; aquaculture; sentience; marine environment.

RESUMEN

Según los expertos, los pulpos son seres altamente inteligentes y sensibles, capaces de experimentar una amplia gama de emociones como el placer, el dolor y la angustia. Originalmente

consumido en el Mediterráneo y el sudeste asiático, el pulpo es ahora cada vez más buscado en nuevas partes del mundo. Estos animales con extraordinarias habilidades cognitivas son ahora el tema de proyectos de acuicultura a gran escala, como el apoyado por la empresa española Nueva Pescanova. Dadas las numerosas cuestiones éticas, económicas y legales planteadas por estos proyectos, un estudio pragmático de su relevancia parece crucial. En particular, la falta de disposiciones legales que regulen la cría de estos invertebrados plantea una amenaza real al respeto de su bienestar por parte de la industria. De hecho, la ausencia de disposiciones legales o pautas de buenas prácticas que regulen la cría de estos invertebrados es una amenaza real para el respeto de su bienestar. Dicho esto, un análisis de las regulaciones existentes sobre la acuicultura sugiere que, en cualquier caso, las granjas de pulpos no podrán respetar las complejas necesidades fisiológicas de estos animales. Además, el desarrollo de tales granjas constituye un peligro para el medio marino y un serio obstáculo para la implementación de normas de protección ambiental. Finalmente, los modelos comerciales basados en la acuicultura intensiva de pulpos tienden a no ser económicamente viables y inevitablemente no cumplirán con los requisitos legales de bienestar animal y protección ambiental.

PALABRAS CLAVES

Pulpo; invertebrados; acuicultura; sensibilidad; medioambiente marino.

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1. INTRODUCTION

While[1] aquatic animals were largely overlooked in research, the number of scientific articles on them began to increase in the 1990s.[2] It was then that octopuses were studied more closely and deemed highly intelligent, sensitive beings capable of experiencing a wide range of emotions such as pleasure, excitement, pain, and distress.[3]

Originally consumed in the Mediterranean and Southeast Asia, octopus is now eaten around the world. Thus, these animals with extraordinary cognitive abilities are now the subject of large-scale breeding projects. In 2018, the Spanish Institute of Oceanography (Instituto Español de Oceanografía affiliated with the Ministry of Science, successfully bred octopuses in captivity for the first time.[4]

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1 This academic article was originally published in Spanish in GIMÉNEZ-CANDELA, M., PATRICIO OLIVARES, P. (ed.). Biodiversidad marina y cambio global. Aspectos biológicos, éticos, y jurídicos, (Valencia 2024). The current version includes updates that distinguish it from the first edition.

2 ASHLEY, P.J. Fish welfare: Current issues in aquaculture, in Applied Animal Behaviour Science, 104, 3–4 (2007) 199-235.

3 DE WAAL, F.B., ANDREWS, K. The question of animal emotions, in Science, 375 (2022) 1351-1352.

4 Ministerio de ciencia, innovación y universidades. Gobierno de España. Instituto español de Oceanografia. El Instituto Español de Oceanografía logra reproducir el pulpo en cautividad. Nota de prensa. (2018), in: https://www.ieo.es/documents/10640/6075371/NP_081118_Reproducci%C3%B3n+pulpo+cautividad.pdf/c20037cb-7386-4097-8705-85cbc8a5456c [Last access date: May 8, 2024]

This discovery opened the door to a new activity: the commercial exploitation of the *Octopus vulgaris* species in aquaculture farms. The Spanish Institute of Oceanography reached an agreement with the Galician company Nueva Pescanova, granting them a preferential license option for the patent, to conduct research on octopuses in captivity for future commercial purposes. In June 2021, the fishing company announced a €65 million investment to build facilities in the port of Las Palmas de Gran Canaria for octopus breeding in captivity.[5] A project approved by the port authority and could potentially produce 3,000 tons of octopus annually in terms of market share. Spain leads and appears to be the most advanced country in octopus breeding, but studies are also being conducted in Italy, Australia, Chile, Portugal, and Greece.[6] In Japan, seafood company Nissui reported octopus egg incubation in captivity in 2017, predicting a fully cultivated and market-ready octopus by 2020. In China, up to eight different octopuses' species are currently being experimentally cultivated.[7] It is worth noting that many scientists are contributing tools and technology for genetic modifications that could accelerate industrial octopus aquaculture and other cephalopods.[8]

Considering the many issues raised by these projects in ethical, economic, and legal terms, it seems crucial to examine the viability of these projects. The first part will discuss the sensitivity and intelligence of octopuses, the second will focus on challenges of octopus breeding and explain how this system is in disaccord with animal welfare, the third part will study environmental issues related to these industrial aquaculture farm projects, the fourth part will highlight the reasons why this breeding is not reliable on a large scale, and finally, the fifth part will analyze the absence of legal provisions regulating the breeding of these invertebrates, which seems to be a serious threat to environmental protection and animal welfare.

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5 FERNÁNDEZ, S. La granja de pulpos de La Luz da un paso más en su tramitación pese a los 'peros' de los animalistas, Canarias 7, (2022) in: https://www.canarias7.es/economia/granja-pulpos-paso-20220823192404-nt.html [Última fecha de consulta: 29 de enero de 2024]; FILGUEIRAS, E. La BBC lo tiene claro: clamor entre los científicos contra la cría de pulpos de Nueva Pescanova, Economia digital (2021) in: https://www.economiadigital.es/galicia/empresas/cientificos-de-todo-el-mundo-piden-paralizar-la-cria-de-pulpos-en-acuicultura-de-nueva-pescanova.html [Last access date: January 20, 2024]

6 JACQUET, J., FRANCKS, B., GODFREY-SMITH, P. The octopus mind and the argument against farming it, in Animal Sentience, vol 26, no. 19. (2019) 2.

7 NYU. Center for Environmental & Animal Protection. The case against octopus farming, in: https://wp.nyu.edu/ceap/research/the-case-against-octopus-farming-2/ [Last access date: May 8, 2024]

8 *Ibidem.*

2. OCTOPUSES: SENTIENT BEINGS

Octopuses are solitary beings that inhabit marine habitats. They are carnivorous animals that can also be preyed upon by certain mammals.[9] The ability of these animals to experience a wide range of emotions has now been scientifically proven.[10] From pain to suffering, anxiety, curiosity, excitement, and joy, octopuses are complex animals capable of expressing a broad spectrum of emotions.[11]

Additionally, the octopus is a sentient being with a very high level of intelligence. It is among the most intelligent invertebrates with a diverse range of behavior. The octopus's brain contains around 170 million nerve cells,[12] and its arms, with 300 million neurons,[13] allow it to taste, touch, and control basic movements without the intervention of the central brain.[14] Octopuses are capable of problem-solving, adapting to their environment by changing color in seconds,[15] inventing strategies to protect themselves from predators, and showing a significant capacity for associative learning.[16]

In light of these elements, there is no doubt that octopuses are sentient beings.[17] This characteristic has been formally recognized in Directive 2010/63/EU,[18] aiming

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9 GUERRA. A., ALLCOCK, L., PEREIRAC, J. Cephalopod life history, ecology and fisheries: An introduction, in Fisheries Research, vol.106 (2010) 117–124.

10 European Directive 2010/63/EU of September 22, 2010, on the protection of animals used for scientific purposes, in: https://www.boe.es/doue/2010/276/L00033-00079.pdf [Last access date: January 20, 2024]

11 CARLS-DIAMANTE, S. The octopus and the unity of consciousness, in Biology and Philosophy, vol 32, no.6 (2017) 1269-1287; BORRELLI, L., FIORITO, G. Behavioural analysis of learning and memory in cephalopods, in BYRNE, JH (Ed) Learning and memory: a comprehensive reference, Elsevier, (UK,2008) 605–627.

12 JACQUET, J., FRANKS, B., GODFREY-SMITH, P., SANCHEZ-UAREZ, W. The Case Against Octopus Farming, Issues in Science and Technology, vol 35, no. 2 (2019) 37-44; BIRCH, J., BURN, C., SCHNELL., A., BROWNING, H., CRUMP, A. Review of the Evidence of Sentience in Cephalopod Molluscs and Decapod Crustaceans, in London School of Economics and Political Science (2021).

13 YOUNG, J.Z. The number and sizes of nerve cells in octopus, in Proceedings of the Zoological Society of London (1963) 229–25.

14 GODFREY, SMITH. P. The Mind of an Octopus, in Scientific American Mind, vol 28, no.1 (2017), 62–69.

15 MATHER, J., ANDERSON, R., WOOD, J. Octopus: The Ocean's Intelligent Invertebrate, Timber Press (London, 2010); MEIJER, KUIPER, W. Skin patterning in Octopus vulgaris and its importance for camouflage, in Biology. Doctoral dissertation, Faculty of Science and Engineering (The Netherlands, 1993).

16 PAPINI, M.R., BITTERMAN, M.E. Appetitive conditioning in Octopus cyanea, in Journal of Comparative Psychology, vol 105, no. 2 (1991) 107–114.

17 BROOM, D. (Prof. Cambridge, UK) spoke at the UNESCO Symposium on Animal Welfare from Science to Law, organized in December 2015, by the LFDA, and explained that a sentient being is capable of evaluating the actions of others in relation to one's own and those of others; remember your actions and their consequences; assess risks and benefits; to have feelings; and have a variable degree of consciousness, in: https://www.fondation-droit-animal.org/documents/SymposiumLFDA2015_Abstracts_EN.pdf [Last access date: January 20, 2024]

to provide protection to cephalopods[19] in the field of experimentation.[20] In 2012, the Cambridge Declaration, written by neuroscientists, already pointed to octopuses as the only invertebrates capable of having conscious experiences.[21] Finally, in 2021, the London School of Economics and Political Science corroborated this recognition and questioned the mass cultivation of cephalopods.[22] Therefore, it is urgent and important to ensure the protection of these special animals, particularly in the current context of developing octopus farm projects.

3. A BREEDING METHOD INCOMPATIBLE WITH OCTOPUS WELFARE

With the exponential increase in consumption, octopus are now interesting candidates for large-scale commercial aquaculture due to the growing demand, high value, and rapid growth.[23] However, octopus aquaculture cannot ensure animal welfare because it is based on the principle of industrial farming, confining animals in an environment outside their natural habitat, in enclosed and crowded spaces with few stimuli to occupy them.

In 2018, a team of researchers from the Pescanova Biomarine Center began working with 50 octopuses (*Octopus vulgaris*) born in aquaculture.[24] This research was initiated by the Spanish Institute of Oceanography and after signing an exclusive patent agreement, Pescanova continued research in its facilities.[25] This center is one of the world's largest aquaculture research centers, promoting the development of new technologies to respect animal welfare.[26] But is this really the case?

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18 Directive 2010/63/EU of the European Parliament and of the Council of 22 September 2010 on the protection of animals used for scientific purposes, in: https://eur-lex.europa.eu/legal-content/ES/TXT/HTML/?uri=CELEX:32010L0063&from=EN [Last access date: January 20, 2024]

19 Octopuses are a specific type of cephalopod belonging to the order Octopoda.

20 GIMÉNEZ-CANDELA, M., JIMÉNEZ LÓPEZ, I. La Directiva 2010/63/UE y los cefalópodos. A propósito del Real Decreto 1386/2018, in dA. Derecho Animal (Forum of Animal Law Studies), 10/3 (2019).

21 The Cambridge Declaration on Consciousness, in: https://fcmconference.org/img/CambridgeDeclarationOnConsciousness.pdf [Last access date: January 20, 2024]

22 See Annex.

23 BIRCH, J., BURN, C., SCHNELL., A., BROWNING, H., CRUMP, A. Review of the Evidence of Sentience in Cephalopod Molluscs and Decapod Crustaceans, in London School of Economics and Political Science (2021).

24 Press release from the Nueva Pescanova Group: Pescanova researchers successfully close the octopus reproduction cycle in aquaculture, in: https://www.nuevapescanova.com/fr/2019/07/18/des-chercheurs-de-pescanova-reussissent-fermer-du-cycle-de-reproduction-du-poulpe-en-aquaculture/ [Last access date: January 20, 2024]

25 *Ibidem*

26 Nova News. Newsletter, no.3 (2022), in: https://www.nuevapescanova.com/nuevapescanova/wp-content/uploads/2022/02/NovaNews-3-PBC-FR.pdf [Last access date: January 20, 2024]

3.1. Captivity

Captivity and animals do not mix, as demonstrated by many scientists. Lori Marino, a neuroscientist, and expert in animal behavior, points out that captivity severely damages the brains of intelligent mammals.[27] The same verdict could apply to octopus, intelligent animals often solitary and aggressive in confined spaces. In their natural habitats, they reside in well-spaced burrows, likely influenced by a relationship between feeding areas and repopulation rates.[28] Lack of isolation and proximity to humans can also convey significant stress to octopuses.[29]

These animals also need to swim by jet propulsion or even walk on the seabed using their tentacles.[30] Intensive octopus production will only be possible in sterile, controlled, and barren environments, and as a result, octopuses will lack sensory information. However, we have already noted how octopuses are sensitive to their environment. Observations in captive cephalopods have shown many signs of stress,[31] such as agitation, depression, and even anorexia.[32] In severe cases, animals may exhibit signs of self-mutilation. In addition to their psychological suffering, their physical suffering must also be considered. These animals with very fragile skin lack an internal or external skeleton that could protect them, meaning that in a captive environment, octopuses are highly susceptible to severe injuries, either from human handling, interactions with their peers, or exposure to cage walls. It should also be noted that these injuries often heal poorly, become infected, and can cause permanent damage or even death if the infection spreads.[33]

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27 CASAL, P. Entrevista a Lori Marino, in Metode, (2022), in: https://metode.es/revistas-metode/entrevista-es/entrevista-a-lori-marino.html [Last access date: January 20, 2024]

28 IGLESIAS, J., FUENTES, L., VILLANUEVA, R. (Eds.). Cephalopod Culture, Springer, (Netherlands, 2014), 17-39.

29 WENISCH, E. Les stéréotypies des animaux élevés en captivité: étude bibliographique, Thèse d'exercice, Ecole Nationale Vétérinaire de Toulouse (2012) 136.

30 SAUER, WH., et al. World Octopus Fisheries, in Reviews in Fisheries Science and Aquaculture,vol 29, no. 3 (2019).

31 MCDONALD, K. Husbandry guidelines for mourning cuttlefish (2011) in: https://aszk.org.au/wp-content/uploads/2020/03/Invertebrates.-Mourning-Cuttlefish-2012KM.pdf [Last access date: January 20, 2024]

32 HAYTER, J. Blue ringed octopus husbandry manual, (2005), in: http://nswfmpa.org/Husbandry%20Manuals/Published%20Manuals/Invertebrata/Blue%20Ringed%20Octopus.pdf [Last access date: January 20, 2024]

33 COOKE, G.M., TONKINS, B.M. Behavioural indicators of welfare exhibited by the common European cuttlefish (Sepia officinalis), in Journal of Zoo and Aquarium Research vol 3, no.4 (2015) 157-162; HANLEY, J.S., SHASHAR, N., SMOLOWITZ, R., BULLIS, R.A., MEBANE, W.N., GABR, H.R., HANLON. R.T. Modified laboratory culture techniques for the European cuttlefish Sepia officinalis, in the Biological Bulletin, vol 195 no.2 (1998) 223–225; SHERRILL, J., SPELMAN, L.H., REIDEL, C.L., MONTALI, R.J. Common cuttlefish (Sepia officinalis) mortality at the National Zoo-

Water quality is also a key criterion to ensure cephalopod health. Therefore, this water must be constantly subject to strict control of oxygen levels, pH, CO2, nitrates, and salinity.[34] Poor water quality can lead to health problems, infections, respiratory issues, restlessness, increased incidence of inking and jetting, and even death.[35] However, there is a real difficulty today in maintaining water quality in octopus basins, and as a result, a high mortality rate has been observed in hatchlings.[36] Therefore, octopuses kept in captivity tend to be more aggressive, experience more stress, risk chronic injuries, and contract more diseases.[37] Unable to live in captivity, octopuses would thus endure a true ordeal in tanks, as aquaculture farms would be unable to offer them living conditions suitable for their physiological needs.

3.2. Capture and transport

No study published to date explicitly evaluates different cephalopod capture and transport methods in terms of their impact on welfare.[38] To assess possible risks of mistreatment or harm to animals, it is necessary to rely on data from capture and handling studies that have captured cephalopods for scientific purposes. However, it has been shown that cephalopods captured in the wild generally die shortly after being removed from the water, suffering physical trauma such as asphyxiation. Many octopuses may have a weakened immune system after experiencing significant stress related to capture.[39]

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logical Park: implications for clinical management, in Journal of Zoo & Wildlife Medicine vol 31 (2000) 523–531.

34 COOKE, G. M., TONKINS, B.M., MATHER, J.A. Care and Enrichment for Captive Cephalopods, in CARERE C., MATHER J. (Eds), The Welfare of Invertebrate Animals (Switzerland, 2019) 179-208; FIORITO, G., AFFUSO, A., BASIL, J., COLE, A., De GIROLAMO, P., D'ANGELO, L., DICKEL, L., GESTAL, C., GRASSO, F., KUBA, M. and Mark, F.Guidelines for the Care and Welfare of Cephalopods in Research–A consensus based on an initiative by CephRes, FELASA and the Boyd Group, in Laboratory Animals vol 49 Suppl. 2 (2015) 1–90; HAYTER, J., *op. cit*; MCDONALD, K., *op. cit.;* VAZ-PIRES, P., SEIXAS, P., BARBOSA, A. Aquaculture potential of the common octopus (Octopus vulgaris Cuvier, 1797): a review, in Aquaculture, vol. 238, no. 1-4 (2004); SYKES, A. V., BAPTISTA, F.D., GONÇALVES, R.A., ANDRADE, J.P. Directive 2010/63/EU on animal welfare: a review on the existing scientific knowledge and implications in cephalopod aquaculture research, in Reviews in Aquaculture, vol 4 no.3 (2012) 142-162.

35 HANLEY, J.S., et al. *op. cit*.; HAYTER, J. *op. cit*.; FIORITO, G. *op. cit.*

36 VAZ-PIRES, P., and al. *op. cit.* 221-238

37 JACQUET J., et al. *op cit.*

38 Although there is currently FELASA (Federation of European Laboratory Animal Science Associations) that aims to develop a set of good practices for the capture and transport of cephalopods.

39 BARRAGÁN-MÉNDEZ, C., SOBRINO, I., MARÍN-RINCÓN, A., FERNÁNDEZ-BOO, S., COSTAS, B., MANCERA, JM., RUIZ-JARABO, I. Acute-stress biomarkers in three octopodidae species after bottom trawling, in Frontiers in Physiology vol 10 (2019).

Additionally, many transport techniques may also appear dangerous for cephalopods. They constantly need highly oxygenated water, and prolonged transport can lead to a drop in oxygen and an increase in nitrates.[40] Furthermore, if animals' ink in the water and the water is not cleaned, the ink can cover the gills and cause asphyxiation.[41] All these observations highlight that breeding conditions are not optimal, especially concerning the principles of the five freedoms resulting from ensuring satisfactory animal welfare: freedom from hunger, thirst, and malnutrition, freedom from discomfort and pain, freedom from injury and disease, freedom from fear and distress, freedom to express normal species behavior.[42] Because of this, transport is not suitable for octopuses.

3.3. Octopus diet

Octopuses are carnivorous animals that require large amounts of live prey.[43] In nature, the search for food is a central activity for marine species, and octopuses excel in this area due to their intelligence. Therefore, they avoid visiting feeding areas where resources have been depleted when they know there is nothing left based on their previous visits.[44]

It's essential to consider that life in a tank, devoid of any cognitive stimulation,[45] would prevent octopuses from engaging in their natural behaviors, especially their

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40 IGLESIAS, J., SÁNCHEZ, F.J., BERSANO, J.G.F., CARRASCO, J.F., DHONT, J., FUENTES, L., LINARES, F., MUÑOZ, J.L., OKUMURA, S., ROO, J. Rearing of Octopus vulgaris paralarvae: Present status, bottlenecks and trends, in Aquaculture, vol 266 no. 1-4 (2007) 1-15 FIORITO, G., et al. *op. cit.*; MCDONALD, K., *op. cit.*

41 MCDONALD, K., *op. cit;* HAYTER, J., *op. cit.*

42 Starting in the 1970s, a committee of experts proposed five major principles — the five freedoms — that, although they do not define well-being, establish the points of attention that must be paid so that animals enjoy satisfactory well-being. These principles are included in the Terrestrial Animal Health Code in article 7.1.1: https://www.woah.org/fileadmin/Home/esp/Health_standards/tahc/2011/es_chapitre_1.7.1.pdf [Last access date: January 20, 2024]

43 IGLESIAS, J., et al. *op. cit.;* NAVARRO, J. C., MONROIG, Ó., SYKES, AV. Nutrition as a key factor for cephalopod aquaculture, in IGLESIAS, J., FUENTES, L., VILLANUEVA, R. (Eds.) Cephalopod Culture (Netherlands, 2014) 77–95; PIERCE, G. J., ALLCOCK, L., BRUNO, I., BUSTAMANTE, P., GONZALEZ, A., GUERRA, Á., JEREB, P., LEFKADITOU, E., MALHAM, S., PEREIRA, J., AND PIATKOWSKI, U., et al. Cephalopod biology and fisheries in Europe, ICES Cooperative Research Report, vol 303 (2010); KIRKWOOD, J., HUBRECHT, R.(Eds). The UFAW handbook on the Care and Management of Laboratory and Other Research Animals. 8th edition, (Denmark, 2010) 787-793.

44 FORSYTHE, J.W., HANLON, R.T. Foraging and associated behavior by Octopus cyanea Gray, 1849 on a coral atoll, French Polynesia, in Journal of Experimental Marine Biology and Ecology vol 209 no. 1-2 (1997) 15-31; MATHER, J.A., O'DOR, R.K. Foraging Strategies and Predation Risk Shape the Natural History of Juvenile Octopus Vulgaris, in Bulletin of Marine Science vol 49 no.1-2 (1991).

45 COOKE, G.M., TONKINS, B.M. Behavioural indicators of welfare exhibited by the common European cuttlefish. Sepia officinalis, in Journal of Zoo and Aquarium Research, (2015) 157-162; JAC-

remarkable hunting abilities. However, at the current state of science, there is not enough information to develop substitute foods.[46] As researchers O'Brien, Roumbedakis, and Winkelmann pointed out in a 2018 article, the lack of scientific studies on the nutritional needs of octopuses does not allow for defining an optimal diet at present.[47] Therefore, it is not possible to know precisely whether the food derivatives that companies will provide to octopuses in tanks or the available amounts actually cover their nutritional needs. Additionally, experiments attempting to replace live prey with formulated diets have not yielded conclusive results.[48] The absence of natural behavior expression, deprivation of live prey, inability to provide satisfactory derivatives, and difficulty in providing favorable amounts for the animal's development would inevitably lead to malnutrition and nutritional and metabolic diseases in aquaculture farms.

3.4. Slaughter methods

Currently, the only available method to painlessly kill cephalopods would be an overdose of anesthetic, usually followed by decerebration.[49] However, this method would not be suitable for cephalopods sacrificed for human consumption because it would affect the meat.

Another existing method is mechanical slaughter, involving a technique to cut or pierce the animal's brain.[50] There might be doubts about the viability of large-scale mechanical slaughter. Furthermore, this method cannot be entirely painless. The same problem also arises for octopuses captured in their natural habitats. Various slaughter methods, such as bludgeoning, brain-cutting, skin turning, and asphyxiation in a bag,[51] are currently used on fishing vessels in European waters. It is clear that much needs to be

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QUET, J., et al. The Case Against Octopus Farming, Science and Technology, vol 35, no. 2 (2019) 37–44.

46 O'BRIEN, C. E., ROUMBEDAKIS, K., WINKELMANN, I. E. The current state of cephalopod science and perspectives on the most critical challenges ahead from three early-career researchers, in Frontiers in Physiology vol 9 (2018).

47 "(…) a lack of knowledge regarding optimal nutritional requirements" in O'BRIEN C., et al. *op. cit.*; FIORITO G., et al., *op. cit.*

48 PIERCE, GJ., et al., *op. cit.*

49 ANDREWS, P. L., et al. The identification and management of pain, suffering and distress in cephalopods, including anaesthesia, analgesia and human killing, in Journal of Experimental Marine Biology & Ecology vol 447 (2013) 46–64; BOYLE, P. R., *op. cit*; FIORITO, G., *op. cit.*

50 ANDREWS, P. L., DARMAILLACQ, A.S., DENNISON, N., GLEADALL, I.G., HAWKINS, P., MESSENGER, J.B., OSORIO, D., SMITH, V.J. The identification and management of pain, suffering and distress in cephalopods, including anaesthesia, analgesia and human killing, in Journal of Experimental Marine Biology & Ecology (2013) 46–64; BOYLE, P. R., *op. cit.*; FIORITO, G., et al., *op. cit.*

51 CIWF. Cría intensiva de pulpos: Una receta para el desastre, (2021), in: https://www.ciwf.org/media/7447177/160889_ciwf_octopus_es_pdr-el_aw_lr2.pdf [Last access date: January 20, 2024]

done regarding octopus slaughter techniques, as they are subject to impactful measures that in no way prevent them from avoiding stress and pain at the time of their sacrifice.

Since 2001, at the request of its member states, the World Organisation for Animal Health (OIE) has positioned itself as a unique global contributor to the reflection on animal welfare. The OIE defines animal welfare as the physical and mental state of an animal in relation to the conditions in which it lives and dies. Thus, the comparison made here between scientific data regarding the physiological needs of octopuses and welfare criteria defined generally easily determines that octopus aquaculture projects cannot concretely ensure a suffering-free end of life. According to current knowledge, there is no cruelty-free method for sacrificing cephalopods.

4. ENVIRONMENTAL ISSUES RELATED TO OCTOPUS FARMING

While not all forms of aquaculture practices damage the environment, some of them do pose significant risks, such as marine pollution and potential impacts on marine biodiversity, particularly concerning the sourcing of food for octopuses. In this section, we will explore issues related to marine pollution, with waste discharge being a primary cause, as well as concerns regarding octopus feeding, which could have ecological implications.

4.1. Issues related to marine pollution: waste discharge – the main cause of pollution

Among the potential sources of environmental pollution from aquaculture centers, waste discharge is one of the most significant. According to DOSDAT, four types of aquaculture waste pollute the marine environment: unconsumed feeds by cultivated species, undigested feeds, indigestible compounds, and feces.[52]

Since the octopus is an animal that needs large amounts of food to survive and is also a heterotroph, meaning it obtains its vital energy by feeding on complex molecules,[53] captive octopuses could contribute to the spread of pathogens and diseases in the wild marine ecosystem. In this regard, it is interesting to note that Nueva Pescanova has indicated that it does not want to use antibiotics in treating octopuses. This is a particularly surprising statement considering how diseases can spread among captive individuals in close proximity. However, even in the unlikely event that the company

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52 DOSDAT, A. Environmental impact of aquaculture in the Mediterranean: nutritional and feeding aspects, in Cahier Options Mediterranéennes, no. 55 (2001) 23-36.

53 *Ibidem.*

adheres to its claims, the impact of alternatives to drugs in the marine environment and their toxic effects on biodiversity has not been evaluated to date.[54]

In the case of octopus, no relevant pathologies have yet been identified, as they have never before been raised on farms. Due to their wild nature and the lack of experience in breeding them in a controlled environment, knowledge about potential diseases specific to this species is limited.[55] Therefore, it is likely that medication will need to be used.

Therefore, octopus farming, whether due to feed or antibiotic — or other drug — discharge, would seriously contaminate the marine environment in which it is located. Moreover, the fact that all soluble or insoluble waste is discharged into the water makes its elimination very difficult.[56] Consequently, the degradation of water quality due to aquaculture has a significant impact on animals living in the ocean, and octopus farming would add more pollution to an environment that does not need more contamination.

Given that this aquaculture project by PESCANOVA could pose risks to the environment and water, approvals from the Canary Islands government must be obtained, such as the environmental impact permit, permits for land-sea discharges, and the concession of the public port domain in the service area of the Port of Las Palmas.

The aquaculture farm will be located on land reclaimed from the sea during the construction of the La Esfinge Dam on a plot of 52,691.51 m2. Discharge into the sea will consist exclusively of seawater from the aquaculture operation. Industrial, rainwater, and fecal origin waters will be collected by the municipal/port sanitation system, previously treated if necessary. However, the discharge area is within a physical distance of less than 2 km from the ZEC Marine Area of Isleta. The annual volume of operation water discharge will be approximately 171,000,000 m3.[57]

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54 Information provided by PACMA following the allegations they sent with the help of a law firm outside the political party.

55 Although we already have some avenues for reflection thanks to this paper: FORSYTHE, J. W., HANLON, R.T., LEE, P. G. A synopsis of cephalopod pathology in captivity. Proceedings of the 18th Annual IAAAM Conference, vol 1, no. 4. (1987), in: www.vin.com/apputil/content/defaultadv1.aspx?pId=11104&id=3981710&print=1 [Last access date: May, 9, 2024]

56 PETIT, J. L'aquaculture: un problème pour l'environnement ?, in INRA Productions Animales (1991) 67-80.

57 Inquiry regarding the approval of the project titled "nueva granja de cultivos marinos en las palmas de gran canaria" — "New Marine Farming Facility in Las Palmas de Gran Canaria," to be executed at the Port of Las Palmas de Gran Canaria (Dársena de la Esfinge), and promoted by the entity Nueva Pescanova, S.L. (Grupo Nueva Pescanova). Municipality of Las Palmas de Gran Canaria. Insular Water Council of Gran Canaria. March, 2022.

Thus, on July 23, 2021, a document was submitted requesting authorization for land-to-sea discharges (AVM) for the installation.[58] The project has been sent to the Directorate General for Climate Change and Environment in order to obtain the corresponding Environmental Impact Assessment from that organization. On September 21, 2021, a Technical Report on the request for authorization for land-to-sea discharges was drafted.

After analyzing the technical documentation provided, it was found that not all aspects required in the Order of July 13, 1993[59] were completed. Additional information has been requested through communication from the Directorate General for Climate Change and Environment of the Government of the Canary Islands, dated October 11, 2021, and December 16, 2021.

On December 15, 2021, a new activity authorization request was submitted for the new farm, along with an Environmental Impact Assessment prepared in accordance with the current legislation, Law 21/2013 of December 9,[60] on environmental assessment, and the First Additional Provision of Law 4/2017 of July 13, on land and protected natural spaces in the Canary Islands.[61]

Furthermore, the Nueva Pescanova Group has submitted a technical document dated January 11, 2022, in response to the repeated clarifications requested in the requirement dated December 16, 2021, by this Directorate General for Climate Change and Environment.

On February 18, 2022, the Director General for Climate Change and Environment, Department of Ecological Transition, Climate Change, and Territorial Planning of the Government of the Canary Islands, requested a report within the framework of the land-to-sea discharge authorization process. A simplified environmental impact assessment is required, in accordance with the regulations at the state level for environmental impact assessment, specifically Law 21/2013 of December 9 on environmental assessment, as the installation is for intensive aquaculture with an annual production capacity exceeding 500 tons, specifically 3,000 tons annually.[62]

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58 Administrative authorizations for discharges from land to sea fall under the responsibility of the Vice Ministry for Climate Change Mitigation and Ecological Transition, in accordance with Article 24.2 del Reglamento Orgánico de la Consejería de Transición Ecológica, Lucha contra el Cambio Climático y Planificación Territorial, approved by Decree 54/2021, dated May 27.

59 Orden de 13 de julio de 1993 por la que se aprueba la instrucción para el proyecto de conducciones de vertidos desde tierra al mar: https://www.boe.es/buscar/doc.php?id=BOE-A-1993-19593

60 Ley 21/2013, de 9 de diciembre, de evaluación ambiental: https://www.boe.es/buscar/act.php?id=-BOE-A-2013-12913

61 Ley 4/2017, de 13 de julio, del suelo y de los espacios naturales protegidos de Canarias: https://www.boe.es/buscar/act.php?id=BOE-A-2017-10295

62 We are talking about tons and not numbers of individuals, which tends to make animals even more invisible.

Three reports issued by the Maritime Captaincy in Las Palmas de Gran Canaria, the Ministry of Defense, and the Directorate General of Fisheries are favorable.

After reviewing the submitted documentation, the Directorate General for Climate Change and Environment sent a letter dated June 16, 2022, to the Directorate General of Fisheries, requesting rectification of the administrative and environmental documentation.[63] On June 29, 2022, a letter from the Directorate General of Fisheries was received at the Directorate General for Climate Change and Environment, requesting rectification of the environmental documentation in order to initiate the procedure. Nueva Pescanova had expected to start its operations in 2023, but administrative requests are experiencing delays beyond what was anticipated. As for the administrative procedure, no progress has been recorded so far, or at least, we have not been informed about it.

If allowed to operate, this project could pose serious biophysical and biosafety risks regarding the effluents produced in this facility and discharged into surrounding waterways. The Directorate General for Climate Change and Environment requested from Nueva Pescanova a detailed description of the microfiltration treatment to be conducted, as well as estimations of the contaminated load in terms of various substances. However, Nueva Pescanova's response did not adequately provide the requested information.[64]

Upon their acquisition, this project stands to emerge as a significant commercial enterprise. However, it raises concerns regarding its ecological impact. The operation poses a potential threat to the marine environment, with the potential for adverse effects on local aquatic ecosystems. These include the possibility of interactions between wild and farmed animals, as well as the transmission of pollutants via farm discharges, highlighting the importance of careful environmental management in aquaculture endeavors.[65] We consider that the Environmental Impact Assessment (EIA) conducted by the company did not perform a relevant analysis to examine the industrial biological interactions that could occur as a result of large-scale production practices, and it did

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63 Request from the promoter to initiate the simplified EIA and clarifications regarding the species to be cultivated.

64 Comments on the Environmental Impact of Nueva Pescanova before the Government of the Canary Islands: General Directorate of Fisheries and the General Directorate for the Fight against Climate Change and the Environment, in: https://static1.squarespace.com/static/5e4ff4ae6791c303cbd43f67/t/627281b35314ee1453e9bca8/1651671476170/Respuesta+a+gobierno+Canarias%2C+granja+pulpos+final.pdf [Last access date: May, 9, 2024]

65 Boletín Oficial de Canarias núm. 69, Dirección General de Lucha contra el Cambio Climático y Medio Ambiente.— Announcement making public the Resolution of February 19, 2022, which opens the public information process for the file related to the authorization for land-to-sea discharge for the new marine cultivation farm project in Las Palmas de Gran Canaria, promoted by Nueva Pescanova, S.L. (Nueva Pescanova Group), located in the Sphinx Dock, Port of Las Palmas de Gran Canaria.. VM-251-LP.-Expte. 2021/29093.

not establish safety mechanisms to protect local ecological communities or the public health of the Canarian community. It is crucial, therefore, for the Canarian City Council to adopt a more ecological and sustainable perspective on economic activities in its territory. Otherwise, its decisions will always be susceptible to legal challenges due to the numerous irregularities of the project and its particularly harmful environmental consequences.

4.2. Issues related to octopus feeding: an ecological disaster

Similar to other carnivorous aquaculture systems, octopuses need to be fed wild fish. As a result, octopus farming would increase the pressure on wild aquatic animals since octopuses require a carnivorous diet based on unsustainable fishing practices, creating additional stress on already scarce marine resources.[66]

One of the main arguments supporting the development of aquaculture was its potential to reduce pressure on wild fish species. However, numerous studies have shown the disaccord of farming marine species, particularly carnivorous ones, with this sustainability goal.[67] In fact, marine species aquaculture heavily relies on the use of processed feeds produced from wild fish.[68] For example, it is estimated that up to 250 wild fish may be needed to raise a single farmed salmon.[69] Therefore, a significant portion of aquaculture worldwide depends on the ongoing exploitation of wild fishery resources on a large scale,[70] even as populations continue to decline globally.[71]

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66 FREE, C. M., THORSON, J. T., PINSKY, M. L., OKEN, K. L., WIEDNMANN, J., JENSEN, O. P. Impacts of historical warming on marine fisheries production, in Science, vol 363, no. 6430 (2019) 979-983.

67 Refer to the relevant source for further details:ALLSOPP M., JOHNSTON, P., SANTILLO, D. Challenging the aquaculture Industry on Sustainability, Greenpeace Research Laboratories, University of Exeter,(UK, 2008), in: https://planet4-canada-stateless.storage.googleapis.com/2018/06/challenging-aquaculture.pdf [Last access date: January 20, 2024]

68 In some companies, a trend has been observed to feed non-carnivorous marine species with fish oils and meals, aiming to 'accelerate growth rates': CIWF, in: https://www.ciwf.fr/nos-mobilisations/poissons-les-grands-oublies/les-principaux-enjeux-de-lelevage-de-poissons/ [Last access date: January 20, 2024]; KONAR M., et al. Illustrating the hidden economic, social and ecological values of global forage fish resources, in Resources, Conservation and Recycling, vol 151 (2019).

69 CIWF. Les principaux enjeux de l'élevage de poissons, in: https://www.ciwf.fr/nos-mobilisations/poissons-les-grands-oublies/les-principaux-enjeux-de-lelevage-de-poissons/ [Last access date: January 20, 2024]

70 TACON, A.G., METIAN, M. Feed matters: satisfying the feed demand of aquaculture, in Reviews in Fisheries Science & Aquaculture, vol 23, no.1 (2015) 1-10.

71 34.2% of the world's fish stocks are exploited at an unsustainable level. See: FAO. The State of World Fisheries and Aquaculture 2020. Sustainability in action. (Rome, 2020).

However, the depletion of marine species has many consequences, both ecological and socio-economic.[72] Due to the interdependence between species, the scarcity of some has direct negative consequences on the balance of marine ecosystems.[73] The development of the exploitation of certain fish for the feed of species raised in aquaculture has led to an increase in their cost, making them inaccessible to certain communities.[74] Besides its ecological implications, the depletion of marine resources creates real economic and food insecurity.[75] Therefore, octopus farming will undoubtedly contribute to this scheme.

These carnivorous animals exclusively feed on live prey in nature.[76] It is commonly accepted that octopuses must be fed twice a day[77] and require food equivalent to three times their body weight.[78] Therefore, octopuses depend on large quantities of marine resources to grow and stay healthy. It should be noted, concerning the "fish-in/fish-out" ratio, that carnivorous marine species require a food supply they do not produce,[79] making the system resemble a true "barrel of Danaides." In any case, octopus farming will not escape this observation.

Far from representing "the best hope for sustaining wild stocks",[80] octopus aquaculture, on the contrary, poses an additional threat as it requires a massive supply of fishery resources and does not supplant the demand for wild products but, in fact, creates additional demand.[81]

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72 *Ibidem.*

73 HUNTINGTON T., HASAN, MR. Fish as feed inputs for aquaculture-practices, sustainability and implications: a global synthesis, FAO (2009); PAULY D., et al. Fishing Down Marine Food Webs, in Sciences vol 279 (1998) 860-863.

74 TACON, AG., et al. Use of fishery resources as feed inputs for aquaculture development: trends and policy implications, FAO Fisheries Circular. N°1018 (2006); WIJKSTROM, U.N. The use of wild fish as aquaculture feed and its effets on income and food for the poor and the undernurished, in HASAN MR, HALWART M. (Eds.), Fish as feed inputs for aquaculture: practices, sustainability and implications, Technical Paper n°518, FAO (2009) 371-407.

75 ALLSOPP M., et al., *op.cit.*

76 PIERCE, G., et al., op. cit.; NAVARRO JC, et al. Nutrition as a key factor for cephalopod aquaculture, in IGLESIAS J., et al. (Eds.), Cephalopod Culture (2014) 77-95.

77 KOLKOVSKI, S., et al., Development of octopus aquaculture. Final Report, Fisheries Research Division Report N°262, Project No. 2009/206. Department of Fisheries, Western Australia, (2015), 144, in: http://www.fish.wa.gov.au/Documents/research_reports/frr262.pdf [Last access date: January 20, 2024]

78 BRYCE, E. Should we farm octopus?, in anthropocenemagazine.org, (2019), in: https://www.anthropocenemagazine.org/2019/02/should-we-farm-octopus/ [Last access date: January 20, 2024]

79 HUNTINGTON, T., HASAN, M.R. Fish as feed inputs for aquaculture-practices, sustainability and implications: a global synthesis, FAO (2009); ALLSOPP, M., et al., op. cit.

80 FLETCHER, R. A Visit to the Octopus Farming Pioneers: Nueva Pescanova. The Fish Site website, https://thefishsite.com/articles/a-visit-to-the-octopus-farming-pioneers-nueva-pescanova [Last access date: May 30, 2024]

81 LONGO S. B. et al. Aquaculture and the displacement of fhisheries captures, in Conservation Biology, vol 33, issue 4 (2019), in: https://conbio.onlinelibrary.wiley.com/doi/abs/10.1111/cobi.13295 [Last access date: January 20, 2024]

All these data imply that, to meet the nutritional needs of octopuses in aquaculture, manufacturers will increase the already unsustainable pressure they exert on wild marine species and, indeed, accentuate the deplorable consequences of resource depletion.

5. OCTOPUS FARMING: AN UNSUSTAINABLE BUSINESS

The octopuses farming plunges us into a labyrinth of complex considerations. The fate of these animals unveils a web of challenges, as until now, octopuses have not been produced in aquaculture farms, and therefore, their needs are poorly understood as individuals that have never been bred in captivity.[82] There is very little documentation detailing the standards for cephalopod and octopus farming.[83]

While the allure of commercial ventures may seem promising initially, suggesting that it could satisfy a new market and potentially aid in conservation efforts, reduce protein costs, supply gourmet markets, etc.,[84] in reality, the harsh realities of maintaining profitability in octopus aquaculture swiftly emerge as a formidable barrier.

One of the primary challenges inherent in octopus aquaculture pertains to the provision of adequate nutrition for these cephalopods within captive tank environments. Octopuses, being carnivorous organisms, exhibit a high dependence on substantial quantities of marine resources for sustenance, necessitating twice-daily feedings equivalent to three times their body weight. This reliance on live prey[85] engenders significant ecological apprehensions and imposes substantial financial burdens on aquaculture enterprises.[86] Despite potential attempts to mitigate these challenges through the substitution of live prey with fishmeal, the resultant costs persist at elevated levels, while questions persist regarding the nutritional sufficiency of such dietary alternatives. Moreover, the procurement of live prey remains an indispensable aspect of octopus farming, particularly during the early stages of juvenile development.[87] Even in scenarios where a transition away from live prey-based diets is contemplated for adult specimens, the utilization of fishmeal entails considerable financial outlays and may not optimally support the physiological development of octopuses.[88]

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82 CANCINO, RODEZNO, M., VILLELA CORTÉS, F. Por qué rechazar las granjas de pulpos. Cuestionamientos y reflexiones éticos sobre la conservación, bienestar animal y las éticas centradas en el sufrimiento, in Revista Aurora, vol 16, no. 2 (2023).

83 BROWING, H., VEIT, W. Improving invertebrate welfare. Animal sentience, vol 5, no.29 (2020).

84 CANCINO, RODEZNO, M., VILLELA CORTÉS, F., *op. cit.* 41.

85 PIERCE, G.J., et al., op. cit.; NAVARRO, J.C., et al., *op. cit.*

86 PIERCE, G.J., et al., *op. cit.*

87 *Ibidem.*

88 GARCIA, J. et al., Cost analysis of Octopus ongrowing installation in Galicia, in Spanish Journal of Agriculture Research, vol 2, no.4 (2004) 531-537.

Moreover, the astronomical mortality rates observed in octopuses raised in aquaculture exacerbate the financial strain. Numerous studies have underscored the inherent struggle octopuses face in acclimating to captivity, with particular emphasis on their developmental stages from paralarvae to juvenile and ultimately adult forms. Currently, there are no studies or projects that have provided a viable solution to the colossal mortality rates observed in octopuses as paralarvae Additionally, the solitary nature of octopuses can precipitate aggression towards conspecifics, manifesting in violent interactions that often result in fatal injuries.[89] The stressors associated with proximity and territorial disputes further compound these challenges, occasionally leading to instances of cannibalism among individuals.[90] Despite diligent efforts to optimize environmental conditions, including stringent management of water quality and temperature, the deleterious impact of these intrinsic behavioral traits persists, contributing to notable losses within octopus aquaculture operations.

Thus, despite diligent efforts to optimize environmental conditions, including stringent management of water quality and temperature, the deleterious impact of these intrinsic behavioral traits persists, contributing to notable losses within octopus aquaculture operations.

Finally, one crucial aspect to consider when evaluating the solvency of octopus farms is the paramount importance of maintaining optimal care standards. Any deviation from these standards not only jeopardizes the well-being of the octopuses but also directly impacts the financial sustainability of aquaculture enterprises. In general, it is estimated that the loss rate of octopuses raised in aquaculture is between 20% and 50%.[91] The intricate web of factors encompassing environmental conditions, dietary requirements, and handling protocols highlights the delicate equilibrium necessary to uphold healthy octopus populations.

For instance, deficiencies in designing capture and transport methods tailored to octopuses' unique physiological needs can elevate stress levels and subsequently increase mortality rates.[92] Similarly, lapses in tank maintenance, such as inadequate water quality (residues from food and ink should be removed regularly)[93] or temperature control (temperature should not exceed 23 degrees)[94], can compromise immune function and heighten susceptibility to disease. Furthermore, neglecting to meticulously determine dietary formulations and feeding schedules may result in nutritional imbalances and hindered

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89 PHAM, C. K. Growth and Mortality of Common octopus (Octopus Vulgaris) Fed a Monospecific Fish Diet, in Journal of Shellfish Research (2009).

90 KOLKOVSKI, S., et al., *op. cit.*

91 LARA, E. Octopus factory farming: a recipe for disaster, Compassion for World Farming Organization. (2021) in: https://www.ciwf.org.uk/research/species-aquatic-animals/octopus-factory-farming-a-recipe-for-disaster/ [Last access date: January 20, 2024]

92 Octopuses have very sensitive skin and require highly oxygenated water, FIORITO., et al*, op. cit.*

93 BIRCH., et al., *op. cit.*

94 KOLKOVSKI., et al., *op. cit.*

growth rates. Each of these elements collectively contributes to an elevated risk of mortality within octopus farms, thereby eroding potential profits. Indeed, the financial repercussions of substandard husbandry practices extend beyond mere direct costs associated with octopus mortality, encompassing broader implications for operational efficiency and long-term viability. Therefore, it becomes increasingly apparent that without a steadfast commitment to comprehensive care protocols, the solvency of octopus farms remains an elusive goal.

The financial burdens of octopus farming cast a long shadow over the industry's ethical landscape, as companies grapple with the daunting task of balancing profitability with animal welfare. Despite significant investments, achieving a sustainable return remains elusive, as highlighted by a meticulous 2004 study. This research exposes octopus farming as a precarious and low-profit endeavor, primarily due to fluctuating costs and the industry's reliance on intricate and resource-intensive systems.[95] In this context, it becomes apparent that meeting the demand for octopus products without compromising animal welfare poses a significant challenge. Efforts to cut costs often lead to a disturbing cycle where neglecting the physiological needs of octopuses ultimately diminishes profitability. The pursuit of profit, at the expense of these intelligent creatures, reflects a troubling trend within the industry.

While promising innovations in feeding and proximity management, spearheaded by figures like Carlos Rosas Vázquez, offer glimmers of hope,[96] the practical application of these advancements within commercial farm settings remains fraught with challenges. Discrepancies between controlled experimental conditions and the harsh realities of farm operations raise doubts about the scalability of such solutions. Thus, a nuanced reevaluation of octopus farming's viability is imperative, considering the pragmatic constraints and logistical intricacies inherent in large-scale aquaculture.

Furthermore, the industry's potential reliance on financial shortcuts underscores the need for a more conscientious approach to sustainable aquaculture. Regulatory frameworks must be established to ensure that profitability does not come at the expense of ethical and legal standards. Without such safeguards, the long-term viability and ethical integrity of octopus farming remain uncertain, emphasizing the urgency for an ethically grounded approach to its cultivation.

6. A CERTAINLY DANGEROUS LEGAL VOID FOR THE FUTURE OF OCTOPUSES

There is a true legal void regarding the standards that should be applied to structures intended for octopus farming. However, while these invertebrates are not covered by

95 GARCIA, J., et al*., op. cit.*

96 SCIGLIOANO, E., *op. cit.*

European legislation with regards to the welfare of farm animals, we anticipate in this section a future evolution (if relevant) of the rules governing octopus farming. However, we also want to point out that such legal criteria, even if formalized in legislative text, will hardly be adhered to by octopus farms, as the physiological needs of the animal are contradictory to life in captivity in a tank. Therefore, instead of providing standards for octopus welfare, it would be desirable to simply ban these farms, following the model of the State of Washington. Indeed, the Washington House Bill 1153,[97] which prohibits octopus farming in the state, has been officially enacted and is the first law of its kind in the world.

6.1. On the development of specific legislation

As the practice of octopus farming continues to gain momentum, questions surrounding the welfare and ethical treatment of these sentient animals come to the forefront. Octopuses pose unique challenges due to their complex biology and behavior. However, the absence of specific legislation or guidelines tailored to their needs underscores the nascent stage of octopus farming endeavors. In light of this, it becomes essential to explore existing standards and regulations governing the welfare of aquatic animals, particularly fish, as a basis for ensuring the proper treatment of octopuses in captivity.

The absence of legislation or guidelines regarding the welfare and breeding of octopuses can be attributed to the relatively recent emergence of octopus farming projects. However, should these projects proceed, it is imperative that they adhere to existing standards. Within the EU, Council Directive 98/58/EC establishes minimum standards for the protection of animals in farming, including fish. Although currently applicable only to fish and not octopus, these standards offer a foundational basis for ensuring the proper treatment of octopuses. Recognizing the inherent distinctions between fish and octopuses, it is clear that insights gleaned from the regulation of marine species can shape discussions surrounding the formulation of specific legislation for octopus farming. Through the review and refinement of existing standards, policymakers can strive to establish comprehensive frameworks. These frameworks aim to safeguard the welfare of octopuses while concurrently promoting sustainable and ethical practices within the aquaculture sector.

In particular, it is necessary to resort to Council Directive 95/58/EC of 20 July 1998, concerning the protection of animals kept for farming purposes, including fish, which contains several important points that may be relevant to octopus farming. Among them is the need for animals to receive adequate food for their age and species (...) supplied in sufficient quantity to maintain them in good health and meet their nutritional needs.[98]

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97 To see the House bill 1153, in: https://perma.cc/PZY3-ANCF [Last access date: May, 9, 2024]

98 Point 14 of the Annex to Council Directive 95/58/EC of July 20, 1998, on the protection of animals kept for farming purposes.

Article 20 of the Directive also states that natural or artificial breeding methods causing or likely to cause pain or suffering or injury to the animals concerned shall not be practiced.[99] These provisions were included in 2005 by the Council of Europe in its recommendations on fish farming in Articles 11 and 17, respectively.[100] In addition, the recommendations state that anyone responsible for fish farming must ensure that reasonable measures are taken to safeguard the welfare of fish, including their health.[101] Similarly, farmed fish must be monitored daily to detect factors affecting their welfare[102] and be attended to by competent personnel capable of assessing their health status, changes in behavior, and the relevance of their environment to their welfare and health.[103]

The Council of Europe, in its recommendations, also refers to the need to take all appropriate measures to reduce stress, aggression, and cannibalism[104] and to construct enclosures that allow for the satisfaction of the essential biological needs of fish and maintain their well-being, including health.[105] The OIE guidelines from 2008 on fish welfare emphasize the importance of ensuring an environment that allows for this. [106]

Finally, the European Commission's Communication of 12 May 2021 titled "Strategic Guidelines for a More Sustainable and Competitive EU Aquaculture for the Period 2021-2030," mentions the criterion of "well-being" of fish bred in aquaculture farms. In particular, the Commission refers to the need to define "common, validated, auditable, and species-specific indicators for fish welfare throughout the production chain" and to continue research and innovation on "species-specific welfare parameters, specifically regarding nutritional needs in different farming systems."[107]

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99 Point 20 of the Annex to Council Directive 95/58/EC of July 20, 1998, on the protection of animals kept for farming purposes.

100 Council Decision on the Community's position regarding a proposal for a recommendation concerning farmed fish to be adopted at the 47th meeting of the Standing Committee of the European Convention for the Protection of Animals Kept for Farming Purposes, Strasbourg, November 2005.

101 Article 3(1) of the Council Decision of 2005.

102 Article 5(2) of the Council Decision of 2005

103 Article 3(4) of the Council Decision of 2005.

104 Article 9 of the Council Decision of 2005.

105 Article 8 of the Council Decision of 2005.

106 Article 7.1.2 of the OIE Guidelines on the Welfare of Fish. (2008), in: https://www.woah.org/es/que-hacemos/normas/codigos-y-manuales/acceso-en-linea-al-codigo-acuatico/ [Last accessed: January 29, 2024]

107 Communication from the commission to the european parliament, the council, the european economic and social committee and the committee of the regions empty. Strategic guidelines for a more sustainable and competitive EU aquaculture for the period 2021 to 2030.2021), in: https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:52021DC0236&from=ES [Last accessed: January 29, 2024]Haut du formulaire
Bas du formulaire

In light of these provisions, it is imperative to revisit and refine existing standards on fish farming conditions in the event of the development of animal farms and/or the creation of specific legislation for their operation.

6.2. On non-compliance with legal requirements

It should be noted that even if the above provisions were extended to octopus farming, and if a text formally established the expected criteria, octopus farms would struggle to comply with the established standards. Indeed, the physiological needs of these live and intelligent animals are difficult to reconcile with life in a tank. Without revisiting these aspects that have already been developed, we will limit ourselves to highlighting some realities.

Among them, it should be noted that welfare requirements, including the need to ensure that animals are healthy, express their natural behavior, and reduce stress and cannibalism, are seriously compromised. There is no doubt that most capacities and needs of octopuses will be stunted in any case by aquaculture. In the absence of welfare indicators and data on the preferred diet of farmed octopuses, confirmed and endorsed by multiple studies, the development of octopus farms does not meet the current requirements set forth by the European Commission.

Furthermore, the creation of octopus farms, due to the high nutritional needs of the animal, would seriously compromise the European goals set in 2021 to reduce the use of wild fish meal and oil.[108]

Lastly, more generally, the European Union recognized early on that animals are "sentient beings",[109] indicating that activities involving them must consider their welfare. This can be seen on a national level in countries like France and Spain, which passed legislation in 2015[110] and 2021[111] respectively. Better yet, England specifically recognized

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108 LARA, E. *op. cit*.; Communication from the commission to the european parliament, the council, the european economic and social committee and the committee of the regions empty. Strategic guidelines for a more sustainable and competitive EU aquaculture for the period 2021 to 2030: https://eur-lex.europa.eu/legal-content/ES/TXT/HTML/?uri=CELEX:52021DC0236&from=ES [Last accessed: January 29, 2024]; LUNA, M., FERNANDEZ-VAZQUES, S., CASTELAO, E.T., FERNÁNDEZ, Á.A. A blockchain-based approach to the challenges of EU's environmental policy compliance in aquaculture: From traceability to fraud prevention, in Marine Policy, vol 159 (2024).

109 Article 13 of the Treaty on the Functioning of the European Union, which came into effect in 2009.

110 Article 2 of the LOI 2015-177 du 16 février 2015 relative à la modernisation et à la simplification du droit et des procédures dans les domaines de la justice et des affaires intérieures: https://www.legifrance.gouv.fr/jorf/article_jo/JORFARTI000030248589 [Last accessed: January 29, 2024]

111 Article 333 bis of the Civil Code, Official State Gazette, December 16, 2021, num 300: https://www.boe.es/boe/dias/2021/12/16/pdfs/BOE-A-2021-20727.pdf. [Last accessed: January 29, 2024]

octopuses as sentient in its amendment to the Animal Welfare Bill,[112] as did the European Union in its Directive 2010/63/EU of the European Parliament and of the Council of 22 September 2010 concerning the protection of animals used for scientific purposes.

Therefore, it is clear that European octopus farm projects, including the one planned by the company Nueva Pescanova, will not meet the legal requirements set at regional and national levels. The PESCANOVA farm poses a real danger to octopuses. If this project materializes and proves its feasibility, it could pave the way for similar projects in the European Union. In the Canary Islands, local officials seem supportive of this project.

Currently, the only potential obstacle would be the failure to obtain the necessary permits by the company, which could be compromised if studies demonstrate that the project is harmful to the environment. However, so far, reports seem rather favorable. Moreover, concerning animal cruelty, there is no need to prove that the animals are well-treated to open this facility.[113]Given this situation, we advocate for the intervention of the European Union to examine the issue of octopus farming and consider its prohibition.

7. CONCLUSION

The discourse surrounding octopus farming encapsulates a myriad of ethical, environmental, and legal complexities, all of which converge to cast doubt upon the viability of such ventures. While the burgeoning aquaculture industry presents promises of food security and economic growth, the pursuit of octopus farming presents unique challenges that cannot be overlooked.

From a physiological standpoint, the intrinsic intelligence and complex behavioral patterns exhibited by octopuses defy the confines of traditional aquaculture settings. Attempts to confine these sentient beings within the constraints of tanks not only impose significant stress and compromise their well-being but also raise profound ethical questions regarding our treatment of non-human animals.

The environmental ramifications of octopus farming are alarming. The high nutritional demands of octopuses necessitate substantial inputs of wild fish meal and oil,

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112 Gov. Uk. Lobsters, octopus and crabs recognize as sentient beings, Department for Environment, Food & Rural Affairs, The Rt Hon Lord Benyon and The Rt Hon Lord Goldsmith (2021), in: https://www.gov.uk/government/news/lobsters-octopus-and-crabs-recognised-as-sentient-beings [Last accessed: January 29, 2024]

113 It can be read in the document "response to the referral of the result of the consultation process and the public information process in the administrative procedure for authorization of discharge from land to sea." written by the company grupo nueva pescanova: Point no. 2.4 – Absence of animal welfare. "Argument not related to the authorization of discharge from land to sea (dls). Therefore, no response will be provided in this document."

exacerbating the strain on already depleted marine resources. In a world grappling with the urgent need for sustainable food production, the establishment of octopus farms represents a regressive step that further destabilizes fragile marine ecosystems.

Moreover, despite the allure of potential profits, the reality is that the inherent challenges in meeting the welfare needs of octopuses within aquaculture systems pose insurmountable obstacles. Any attempt to prioritize economic gains over animal welfare not only runs counter to ethical imperatives but also risks tarnishing the reputation and longevity of the aquaculture industry as a whole.

Furthermore, the absence of robust legal frameworks governing octopus farming is a glaring oversight that demands immediate attention. Without clear guidelines and stringent regulations in place to ensure the protection of octopus welfare, the continuation of such projects is tantamount to regulatory negligence and moral abdication.

In light of these multifaceted concerns, the proposition of a preemptive ban on octopus farming emerges as a prudent and responsible course of action. By preemptively halting the development of octopus farms and enacting comprehensive legislative measures to safeguard animal welfare and environmental integrity, policymakers can demonstrate a commitment to ethical stewardship and sustainable resource management.

In essence, the case against octopus farming extends beyond mere ethical considerations; it speaks to our collective responsibility to protect the planet. By heeding the warnings articulated in this discourse and taking decisive action to prohibit octopus farming, we can chart a course towards a more equitable, compassionate, and sustainable future for all beings.

ANNEX 1

The London School of Economics and Political Science unequivocally acknowledges the great sensitivity of these animals.

Eight criteria were studied:

1) The possession of nociceptors.
2) The possession of integrative brain regions.
3) Connections between nociceptors and integrative brain regions.
4) Responses affected by possible local anesthetics or analgesics.
5) Motivational compensations showing a balance between threat and reward opportunity.
6) Flexible self-protective behaviors in response to injuries and threats.
7) Associative learning beyond habituation and awareness.

8) Behavior demonstrating that the animal appreciates local anesthetics or analgesics when injured.

Summary of confidence levels regarding evidence of sentience in octopuses:

Criteria 1	Criteria 2	Criteria 3	Criteria 4	Criteria 5	Criteria 6	Criteria 7	Criteria 8
Very high level of confidence	Very high level of confidence	High level of confidence	High level of confidence	Medium level of confidence	Very high level of confidence	Very high level of confidence	High level of confidence

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