WORLD AQUATIC ANIMAL DAY
RESOURCE PACKET
APRIL 3, 2021

"The Impacts of our Human Activities on Aquatic Animals"

AQUATIC ANIMAL LAW INITIATIVE
ANIMAL LAW CLINIC
LEWIS & CLARK LAW SCHOOL
WorldAquaticAnimalDay.org

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PART I:
BROAD INTRODUCTORY ISSUES

1. About World Aquatic Animal Day

#worldaquaticanimalday

World Aquatic Animal Day is an annual day dedicated to aquatic animals, launched for the first time on April 3, 2020, and is a project of the Aquatic Animal Law Initiative (AALI) and the Animal Law Clinic at the Center for Animal Law Studies at Lewis & Clark Law School (Clinic/we/us). Each year, we intend to raise global awareness about these often-forgotten nonhuman animals.

Aquatic animals play a critical role in our societies and ecosystems. They are important not only as a group, but also have value and intrinsic worth as individuals. By "aquatic animals" we mean not only fish or whales, but also the many other animals who require aquatic habitats, such as: amphibians, marine mammals, crustaceans, reptiles, mollusks, aquatic birds, aquatic insects, starfish, and corals. Aquatic animals are widely used, and abused, around the world and they, and their habitats, face a multitude of significant threats.

There is urgent need to give aquatic animals proper consideration. Through law, policy, education, advocacy, and good stewardship of the earth, efforts to raise awareness of the plight of aquatic animals must rise to meet the immense challenges they face. We must consider our interactions with aquatic animals, our treatment of them, and the often-devastating impacts we are having on them and on their habitats.

Join us on April 3rd each year as we celebrate these creatures and call for action to protect them through education, law, policy, outreach, and other avenues. With a different focus each year, we will, together, highlight and work to address the issues aquatic animals face.

The theme for 2021 is "**The Impact of Our Human Activities on Aquatic Animals**."

This Resource Packet and other information is on our website: WorldAquaticAnimalDay.org

This Resource Packet is divided into two main Parts, with various sub-sections: Part I deals with some of the Broader Introductory Issues relating to the Clinic, our Work, Aquatic Animals and Their Habitats; and Part II deals with some specific impacts on Aquatic Animals, as well the Resources section, and the Conclusion.

2. About this Resource Packet

A. Background and Rationale

This Resource Packet has been compiled by the students working with the Aquatic Animal Law Initiative (AALI), and Animal Law Clinic at the Center for Animal Law Studies at Lewis & Clark Law School (Clinic) together with AALI Fellow, Amy P. Wilson, and Clinical Professor Kathy Hessler.

The purpose of the Resource Packet is to provide an overview of some of the issues faced by aquatic animals and in particular, set out some of the regulation that applies to these animals. In addition, this document offers links to additional resources where one may look to learn more about the subjects covered here.

As mentioned above, aquatic animals are often invisible victims – yet they account for the largest number of animals impacted by humans – directly or indirectly. By making these animals and the threats they face more "visible," we hope to increase awareness and efforts to protect them.

Legally, animals are categorized as *property*, making it difficult to protect them. Some of the protections that are available require proving cruelty, which is very difficult in the case of aquatic animals who are often out of sight when abuse happens. Additionally, aquatic animals are not included in most of the laws that offer other animals some protection from harm.

Failure to address the welfare of aquatic animals in regulation has led to problematic consequences. It is important to note that use of aquatic animals not only impacts the animals themselves, but also wild animals, workers, consumers, and the environment more broadly. Thus, it is important to pay careful attention to the issues involved in the use of aquatic animals. This is especially true as it is projected that a variety of these uses will continue to significantly rise in the foreseeable future.

B. The Animal Law Clinic

World Aquatic Animal Day is one project of the Clinic which also works on local, national, and international animal law issues in addition to working with the state and local community. Students conduct research, represent clients, and work on clinic projects to develop the field of animal law and encourage consideration of the interests of animals in legal decision-making.

The Clinic promotes the academic and professional growth of its students by working to:

i. Foster the transition from law student to lawyer;
ii. Create life-long learners who are excellent and effective advocates;
iii. Create respectful dialogue on difficult conversations; and
iv. Invite and engage different perspectives.

The Clinic was established in 2008 and was the first animal law clinic in the U.S. It serves as a comprehensive training ground for students interested in a full range of policy and related work to benefit animals through the direct representation of clients. Students conduct legal research, analysis, writing, work on clinic projects to develop the field of animal law, and encourage consideration of the interests of animals in legal decision-making. The Clinic provides an opportunity for students to gain real-world experience working with clients as well as the chance to develop their professional skills.

C. Aquatic Animal Law Initiative (AALI)

The Aquatic Animal Law Initiative works to protect and promote the interests of aquatic animals by:

i. Advocating on their behalf through the legal system;
ii. Promoting their value to the public by providing education about their cognitive, emotional, and physiological capacities; and
iii. Harmonizing human, animal, and environmental interests.

Aquatic animals are too often left out of the legal and regulatory frameworks that provide some protection for other non-human animals. Too little is understood about their welfare, environmental and health, and safety issues associated with aquatic animal use and production. Likewise, too little of the evolving scientific data relating to aquatic animals is available to the public and policy makers. When making decisions affecting their lives, it is important to consider the critical role of aquatic animals within ecosystems, as well as their individual capacities and biological needs.

Given the widespread use of aquatic animals for human goals, it is also important to consider questions raised by that usage - housing, feeding, medical care, transportation, slaughter, processing, breeding, testing, and exhibition. Before 2016, there was no entity dedicated to the legal analysis of these issues. Thus, AALI was created in order to consider the legal, as well as scientific and economic contours of issues resulting from the use of aquatic animals.

D. Disclaimers

The Resource Packet is provided by the Clinic for informational and educational purposes only. It is not a complete source of information of the issues addressed. The resources provided are not exhaustive; they are illustrative and thus limited in scope. It has been compiled by law students, who are not legal professionals or experts in the subject matter covered herein.

Nothing contained in the Resource Packet is intended to constitute (among other things) legal advice. Accordingly, readers should not construe any of the information presented as legal advice. The Clinic recommends consulting with an attorney for specific advice that is tailored to particular legal needs.

The Resource Packet includes legal information from different jurisdictions. It is important to note that the issues addressed may be regulated at federal, state, tribal, and local levels and can vary widely among different jurisdictions within and across countries. Specific laws and regulations may also apply to different species of animals.

The content of the Resource Packet is provided "as is" at the date of publication, April 2021.

The Resource Packet contains resources created by the Clinic itself and by other organizations. Any mistakes in attribution are unintentional. The Clinic is not affiliated with the organizations referenced in the Resource Packet. Inclusion of information or documentation from the organizations referenced in the Resource Packet should not be construed as an endorsement of any organization, its views or its practices.

The Clinic makes no representation or warranty of any kind, express or implied, including, without limitation, any warranties of merchantability, fitness for a particular purpose, title, and/or non-infringement. The Clinic does not accept any responsibility for any loss or damage suffered by any person as a result of reliance on the contents of the Resource Packet.

Some international and foreign resources have been included herein. We do not make any warranties as to the accuracy of these sources, translations, or the information contained therein.

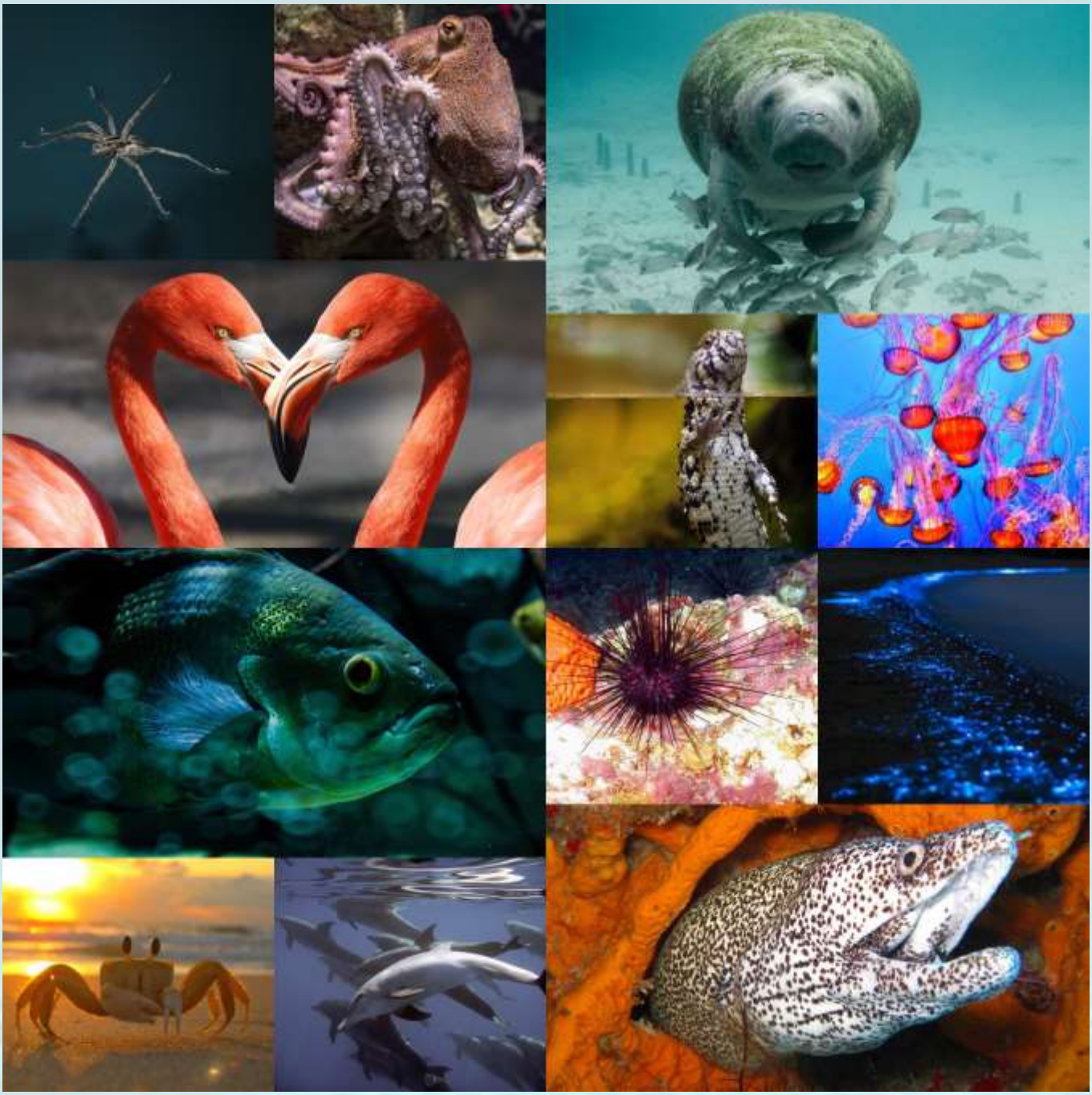
For the sake of brevity, we sometimes utilize the term "fish" as inclusive of other aquatic animals.

While "World Aquatic Animal Day" is a project of the Aquatic Animal Law Initiative of Lewis & Clark and we encourage action for this class of animals, we are not otherwise affiliated with organizations that choose to participate

in this day and neither do we endorse their actions. We encourage all to be respectful and follow the relevant procedures, laws, regulations, and policies that apply to any given action or circumstance.

This is a highly complicated subject and we note that there are various dimensions to it, including but not limited to: political, economic, social, cultural, technological, environmental, legal, and otherwise. We cannot hope to cover all these complexities and considerations, but trust that the Resource Packet provides some information of use and interest. We encourage readers to engage in further research on these and other subjects of interest. We have included some additional resources to assist in further exploration of these topics.

We encourage you to take a look at our 2020 World Aquatic Animal Day Resource Packet, with further information and resources, which can be found here. Some of the information and resources from the 2020 Resource Packet have been included here.



3. Ten Ways to Get Involved

In these challenging times, it can be useful to think of ways to help others. April 3rd is a day to consider aquatic animals: the impact human activity has on them and their habitats, as well as our interaction with, treatment, and use of them. While we know that many people are rightly focused on other things right now, we also know that some people are looking for distractions from the news, ways to continue their learning, and opportunities to advocate for others.

Anyone can be an advocate for aquatic animals, no matter who or where you are. Below is a list of ten ways you can participate in World Aquatic Animal Day. And there are many other ways you can get involved – be creative, think local, and be sensitive to issues raised by the pandemic, as well as economic, political and social upheaval.

Regardless of how you decide to get involved, and whether it is on World Aquatic Animal Day or any other day of the year, let us know what you did and how you chose to participate by taking a photo of your action and sharing on social media and other platforms using the hashtag **#worldaquaticanimalday**.

4. Types of Aquatic Animals and Their Habitats

A. Introduction

When one thinks of aquatic animals, "fin" fish may come to mind. However, it is helpful to recognize the exceedingly vast variety of aquatic animals.

"In biological context, the term *aquatic* is used to relate to water, as in aquatic animals, aquatic plants, aquatic environment, aquatic habitat, and aquatic locomotion."[1]

"Aquatic animals pertain to animals that live predominantly in different water forms, such as seas, oceans, rivers, lakes, ponds, etc. … And these habitats where aquatic animals and plants live on are referred to as aquatic habitats. Aquatic habitats may be freshwater, marine, or brackish water."[2]

"Aquatic animals pertain to animals that live predominantly in different water forms, such as seas, oceans, rivers, lakes, ponds, etc. Examples of aquatic animals include fish, jellyfish, sharks, whales, octopus, barnacle, sea otters, crocodiles, crabs, dolphins, eels, rays, mussels, and so on."[3]

For the Air-Breathing Aquatic Animals, "[m]ost people would assume that all aquatic animals get their oxygen from water, but this isn't always the case. In fact, there are many sea creatures that need to breathe air to survive"[4], including dolphins/whales, manatees, diving bell spiders, mayflies, caddisflies, and lungfish, among others.

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[1] *Aquaculture*, BIOLOGY ONLINE, https://www.biologyonline.com/dictionary/aquatic (last visited Mar. 20, 2020).
[2] *Id.*
[3] *Id.*
[4] *Air Breathing Animals That Live Under Water*, ANIMALOGIC (Jan. 11, 2020), https://animalogic.ca/blog/air-breathing-animals-that-live-under-water .

Below is a list that you may find surprising. This list is by no means a complete one, but it attempts to highlight some of the different groups of aquatic animals.

B. List of Aquatic Animals

i. **Amphibians:** including frogs; toads; newts and salamanders
ii. **Crustaceans:** crabs; lobsters; shrimp; krill; barnacles; wood louse, water flea
iii. **Finfish:** sharks; other finfishes
iv. **Marine mammals:** cetaceans; pinnipeds; polar bears; otters, badgers, beavers; manatees and dugongs
v. **Mollusks:** mussels, oysters Scallops; mussels; cockles; oysters; clams
vi. **Cephalopods:** Nautiluses; squids; octopuses and cuttlefishes
vii. **Reptiles:** Turtles; snakes; iguana; crocodiles; alligators and geckos
viii. **Echinoderms:** Sea stars; sea urchins; sand dollars; sea cucumbers
ix. **Cnidaria:** Corals and jellyfish
x. **Porifera:** Sponges
xi. **Birds:** Penguins; flamingos; seagulls; pelicans; ducks; geese; albatross; puffins
xii. **Aquatic insects**: zooplankton

….and many, many more!

C. Habitats

One may predominantly think of the ocean when thinking of aquatic animal habitats, and while that does indeed cover a large portion of relevant habitats, there are others to consider as well. Aquatic animals can be found in a variety of bodies of water, both freshwater and marine. Aquatic habitats include seas, oceans, rivers, lakes, ponds, coral reefs, wetlands, islands, and others.

In addition, there are a large number of aquatic animals in private or commercial captive settings, including: homes, restaurants, offices, zoos, aquaria, sea parks, schools, ponds, tanks, and various other locations and facilities. The animals in captivity range from small finfish and reptiles to large aquatic mammals such as orcas. Importantly, captive facilities generally cannot adequately provide for the needs of aquatic animals and cause a number of animal welfare issues.

"Aquatic animals are animals that live in the water. They either live in fresh water, such as lakes, rivers, and ponds, or saltwater, like the ocean."[5] "The aquatic biome includes habitats around the world dominated by water. Aquatic ecosystems are divided into two main groups based on their salinity—freshwater habitats and marine habitats. Aquatic ecosystems support a diverse assortment of animals including fishes, amphibians, reptiles, mammals, birds and invertebrates."[6] Aquatic, or semi-aquatic animals, may also rely on water but not live in it entirely.

[5] *Aquatic Animals Information*, STUDY.COM, https://study.com/academy/lesson/aquatic-animals-information-lesson-for-kids.html (last visited Mar. 20, 2020).
[6] *Aquatic Habitats*, WORLD ANIMAL FOUND. (Dec. 19, 2019) https://www.worldanimalfoundation.com/advocate/wild-earth/params/post/1286151/aquatic-habitats.

PART II:
USES AND HUMAN IMPACTS

1. Introduction

For purposes of Part II, we have attempted to highlight just a few of the **many** key uses and human impacts on aquatic animals. This list is by no means a complete one, however, it attempts to show a spectrum.
Within each of these sub-sections, we have highlighted the scope (in terms of some of the actual numbers of animals), some of the harms and issues with each, some of the regulation and legal considerations, and some of the work and efforts being done in this space.

The following are the subjects we have highlighted:

i. Companion Animals
ii. Aquatic Animals in Entertainment
iii. Aquatic Animals in Fashion, Clothing, Décor
iv. Use of Aquatic Animals in Scientific and Biomedical Research and Medicine
v. Pollution and its Effects on Aquatic Animals
vi. Anthropogenic Climate Change Impacts on Aquatic Animals
vii. Aquaculture Impacts
viii. Wild Caught Fishing Impacts
ix. Selected Impacts of COVID-19 on Aquatic Animals

We encourage readers to do further research, and consult a broad variety of different resources!

2. Companion Animals

A. Introduction

Aquatic animals are popular companion animals throughout the world, from goldfish, to exotic reef fish, to reptiles and amphibians. According to the American Pet Products Association's 2019-2020 National Pet Owners Survey, 11.5

million U.S. households own 139.3 million freshwater fish, 1.6 million U.S. households own 18.8 million saltwater fish, and 4.5 million U.S. households own 9.4 million reptiles as companion animals.[7]

Although some aquatic companion animals are captive-bred, many more are wild-caught. For instance, between 95%-99% of all saltwater fish in the market are wild-caught.[8] Many reptiles – which are growing in popularity as companion animals – are either imported into the United States, or are captured from the wild in the United States.[9] Many amphibians are also wild-caught, as are invertebrate aquatic animals.[10] And most live rock and corals – which are increasingly being seen in home aquariums – are wild-caught.[11]

There are also so-called "ranched" or farmed aquatic animals, particularly reptiles. Reptiles who are high in demand, like red-eared slider turtles and green iguanas, "are produced on farms in the United States, Latin America and Africa. These farms have been touted as a way of sustainably producing reptiles for the pet trade while reducing demand for wild-caught animals."[12] Unfortunately, claims of sustainability are not usually proven.

There are a plethora of problems associated with sourcing and keeping aquatic companion animals – whether they are wild-caught, captive-bred, or ranched – including harmful impacts on ecosystems and conservation, illegal trade, and poor welfare.

Another problem with aquatic companion animals is that they are not always legally protected from abuse or neglect in their home environments. This may be because they are exempted from protections, are not included in the definition of "animals", or are not covered by the relevant anti-cruelty laws.

[7] *Pet Industry Market Size & Ownership Statistics*, AM. PET PRODUCTS ASS'N, https://www.americanpetproducts.org/press_industrytrends.asp; *see also*, *2019-2020 APPA National Pet Owners Survey*, AM. PET PRODUCTS ASS'N,, https://www.americanpetproducts.org/pubs_survey.asp (last visited Feb. 14, 2021).
[8] *Poisoned waters: How cyanide fishing and the aquarium trade are devastating coral reefs and tropical fish*, CTR. FOR BIOLOGICAL DIVERSITY (2016), https://www.biologicaldiversity.org/campaigns/reef_fish_in_peril/pdfs/Poisoned_waters.pdf (last visited Feb. 14, 2021).
[9] *The Trade in Live Reptiles: Imports to the United States*, THE HUMANE SOC'Y OF THE U.S., https://www.humanesociety.org/sites/default/files/docs/reptile-trade-import.pdf (last visited Feb. 14, 2021).
[10] Martin Schlaepfer, Craig Hoover & C. Kenneth Dodd, *Challenges in Evaluating the Impact of the Trade in Amphibians and Reptiles on Wild Populations*, 55 BIOSCIENCE 258 (2005); E. J. Livengood & F. A. Chapman, *The Ornamental Fish Trade: An Introduction with Perspectives for Responsible Aquarium Fish Ownership*, UNIV. OF FLA. IFAS EXTENSION, https://edis.ifas.ufl.edu/fa124 (last visited Feb. 20, 2021).
[11] E. J. Livengood & F. A. Chapman, *Id*.
[12] *Reptile Farms and Captive Breeding No Solution to Problems*, ZOO CHECK, https://www.zoocheck.com/feature-campaigns-2015/exotic-pets/reptile-and-amphibian-issues/reptile-farms-and-captive-breeding-are-not-the-answer/?doing_wp_cron=1613857624.2474761009216308593750 (last visited Feb. 20, 2021).

B. Tropical Fishes – Cyanide Capture and Coral Reefs

Many people are not aware of the "dark side" of the tropical fish industry: About 80% of tropical fish imported into the United States are captured illegally using a toxic compound called sodium cyanide.[13] The cyanide is directly sprayed on the fish as well as onto the coral reefs near the targeted fish to briefly stun the fish, making them easier to capture.[14] According to the Center for Biological Diversity, sometimes "55-gallon drums of cyanide have been dumped overboard to capture fish."[15] Because cyanide is poisonous, it can also harm and kill the fish – some instantly, others die hours later.[16] The cyanide also damages the surrounding coral reefs in which many tropical fish live – exposure to cyanide "can have a toxic effect and cause bleaching and death" to corals. [17] Moreover, the cyanide affects and often kills large numbers of non-target fishes who come into contact with it.

C. Reptiles

According to the Humane Society of the United States, many wild reptile populations have been seriously harmed by collection for the pet trade:

> For example, many of Madagascar's tortoises and chameleons have been over-collected for the pet trade and are threatened with extinction. Many reptile species have very slow reproductive rates or exist in very low natural densities, and their populations cannot recover from continued, unregulated collection from the wild. Wild populations of most imported reptile species are not managed, collection from the wild is not controlled, and international trade is not regulated.[18]

The growing demand for reptiles companion animals has also led to the proliferation of "reptile breeding facilities" in foreign countries, as well as in the United States. These facilities "vary from *bona fide* breeding centers to reptile farms, or ranches, which are stocked with wild-caught animals."[19] The reptiles who come from these operations are frequently labeled as "captive-bred," but a number of these foreign reptile breeding facilities have been discovered "to be simply a front to launder wild-caught reptiles."[20] This is done to avoid legal protection of wild animals.

As mentioned previously, reptile farms or ranches have been promoted as a "sustainable" way of producing reptiles for the pet trade while reducing demand for wild-caught animals. However, some of these operations capture reptiles from the wild to replenish adult breeding animals who have died and to increase breeding stock, or they collect eggs from retiles in the wild.[21] Some snake and lizard ranches say they capture pregnant females from the wild, let them lay their eggs in captivity, and then safely release these females back into the wild.[22] According to ZooCheck, "there

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[13] Lauren Kearney, *How the Tropical Fish Pet Trade is Harming Animals and Endangering Coral Reefs*, ONE GREEN PLANET (2016), https://www.onegreenplanet.org/animalsandnature/tropical-pet-fish-industry-endangering-fish-and-coral/ (last visited Feb. 20, 2021).
[14] Lauren Kearney, *Id*; *Analysis: U.S. Pet Trade Imports 6 Million Tropical Fish Exposed to Cyanide Poisoning Each Year*, CTR. FOR BIOLOGICAL DIVERSITY (June 16, 2016), https://www.biologicaldiversity.org/news/press_releases/2016/cyanide-fishing-06-16-2016.html (last visited Feb. 20, 2020).
[15] *Analysis: U.S. Pet Trade Imports 6 Million Tropical Fish Exposed to Cyanide Poisoning Each Year*, CTR. FOR BIOLOGICAL DIVERSITY (June 16, 2016), https://www.biologicaldiversity.org/news/press_releases/2016/cyanide-fishing-06-16-2016.html (last visited Feb. 20, 2020).
[16] Lauren Kearney, *supra* note 13.
[17] *Id*.
[18] *The Trade in Live Reptiles: Imports to the United States*, *supra* note 9.
[19] *Id*.
[20] *Id*.
[21] *The Trade in Live Reptiles: Imports to the United States*, *supra* note 9; *Reptile Farms and Captive Breeding No Solution to Problems*, ZOO CHECK, https://www.zoocheck.com/feature-campaigns-2015/exotic-pets/reptile-and-amphibian-issues/reptile-farms-and-captive-breeding-are-not-the-answer/?doing_wp_cron=1613857624.2474761009216308593750 (last visited Feb. 20, 2021).
[22] *Reptile Farms and Captive Breeding No Solution to Problems*, *supra* note 12.

may be little incentive for them to do that. It is likely that many farms just recycle their spent wild-caught females into the pet or meat trade."[23]

D. Non-indigenous and Invasive Species

Ecosystems can be seriously harmed when nonindigenous and particularly, invasive, species in the pet trade escape into the wild, or when owners of aquatic companion animals intentionally release them into the wild. Studies have found that approximately 6%-7% of aquarium owners released fish into the wild annually.[24] This is a big problem with pet goldfish in particular.[25]

The exotic pet trade "has become the primary venue by which reptiles and amphibians arrive in non-native lands, the first step to becoming ecologically damaging invaders."[26] Reptiles and amphibians are frequently released into the wild by their owners.[27] Release of aquatic companion animals into the wild can hurt native species through disease transmission, predation, and competition for food.[28] The Burmese python is an example of this – since becoming invasive in Everglades National Park in Florida in the 1990s, it has caused significant declines in native mammals and birds.[29]

E. Illegal Trade

The trade of wild-caught aquatic animals, such as reptiles and amphibians is chiefly unregulated, with only a small minority of species monitored by the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES).[30]

As demand for exotic and rare reptiles grows, illegal trade in reptiles has also increased. The United States is the biggest world consumer of illegally traded plants and animals in the world; the value of this illegal trade is currently estimated to be $3 billion a year, and reptile trade comprise a significant part of overall illegal animal trade.[31]

The Internet is a growing platform for both legal and illegal trade of wildlife, including reptiles and other aquatic species.[32] Online sales of aquatic animals has only made things worse by facilitating trade, driving demand up, and making more species available, including nonnative, invasive species.[33]

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[23] *Id.*
[24] *Ethical & Ecological Implications of Keeping Fish in Captivity*, ANIMAL WELFARE INSTITUTE (2015), https://awionline.org/awi-quarterly/2015-fall/ethical-and-ecological-implications-keeping-fish-captivity (last visited Feb 20, 2021);
[25] *See*, for example, Martin Safer, *Aquatic Invaders of the Pacific Northwest; Carassius auratus auratus (Common Goldfish)*(2014), http://depts.washington.edu/oldenlab/wordpress/wp-content/uploads/2015/09/Carassius_auratus_Safer_2014.pdf (last visited Feb. 20, 2021) (discussing the problem of goldfish becoming invasive species not only in the Pacific Northwest, but throughout the U.S.).
[26] *For Exotic Pets, the Most Popular Are Also Most Likely to be Released in the Wild*, RUTGERS (Sept. 28, 2018), https://www.rutgers.edu/news/exotic-pets-most-popular-are-also-most-likely-be-released-wild (last visited Feb. 20, 2021).
[27] *Id.*
[28] *Id.*
[29] *Id.*
[30] *What is CITES?*, https://cites.org/eng/disc/what.php (last visited Feb. 20, 2021); James M. Green,
[31] *The Trade in Live Reptiles: Imports to the United States*, *supra* note 9.
[32] George-Ioan Mărginean, Elena Gherman & Tibor Sos, *The illegal internet based trade in European pond turtle Emys orbicularis (Linnaeus, 1758) in Romania: a threat factor for conservation*, 14 NORTH-WESTERN J. OF ZOOLOGY 64 (2018).
[33] *See* Heather Prestridge, Lee Fitzgerald & Toby Hibbitts, *Trade in non-native amphibians and reptiles in Texas: lessons for better monitoring and implications for species introduction*, 6 HERPETOLOGICAL CONSERVATION & BIOLOGY 324, 335 (2011) (suggesting that increasing availability of nonnative species of turtles in Texas is due to growing Internet trade and suggesting that Internet trade is a plausible explanation of increased availability of other nonnative reptiles and amphibians in Texas), *see also* Sha Liu et al., *E-commerce promotes trade in invasive turtles in China*, ORYX 1-4 (2020) (documenting the scale and spatial pattern of online sales of non-native turtles on

Unfortunately, as long as the demand for companion aquatic animals is high, and people are willing to buy wild-caught individuals, illegal trade will certainly continue, as will the devastating impacts on the ecosystem that result.

F. Poor Welfare

Whether they are wild-caught, ranched, or captive-bred, aquatic companion animals frequently suffer from poor welfare and high mortality and morbidity rates throughout the pet trade supply chain. Capture and pre-sale mortality rates for wild-caught "aquarium" fishes is commonly 80-98%, while the wholesaler "industry standard" mortality rate for amphibians and reptiles is 70% in only 6 weeks.[34] On the consumer end, "disastrous welfare" results in approximately 90% of fishes and 75% of reptiles dying within a year after purchase.[35]

Wild-caught reptiles can experience poor welfare throughout the pet trade timeline, including harsh handling and poor conditions during capture, torn claws, broken limbs, twisted tails and spines, and being crushed.[36] Despite the International Air Transport Association (IATA) requirements, many reptiles become dehydrated, emaciated, and perish during transport.[37] Sadly, even if they do survive the grueling capture and transport process, they may die shortly thereafter from the negative effects of capture and transport.[38]

With ranched reptiles, even if ranches and farms do try to release spent females back into the wild as they claim, these individuals "may not survive, as capture, confinement (often in unsanitary conditions) and egg laying leave the animals stressed and physically depleted. They may fare especially poorly if they are released into unfamiliar areas they did not previously inhabit."[39]

In the homes where these animals are kept, welfare is often substandard. Much of this may be unintentional and has to do with unawareness of their unique needs and requirements. Many mistakenly believe that aquatic animals are inexpensive, low maintenance, "easy to keep," and "can live their entire lives inside a small aquarium."[40] However, these beliefs and misconceptions are not true - fish are not easy to keep, "because of the complexities of maintaining optimal water chemistry, and creating a sustainable, self-contained habitat."[41] Nor are they inexpensive: "Appropriate life-support systems essential for fish-keeping requires significant investment."[42] Poor husbandry is common among keepers of fish, reptiles, and other aquatic companion animals.[43] The welfare of these animals can also be put at risk if the owner loses interest in the animal, the animal grows too large, the species is long-lived, or the owner finds characteristics of the animal unsuitable (too active, not active enough, etc.).[44]

China's Taobao.com e-commerce site, which suggests that substantial online sale of alien turtles could be having detrimental effects in the Yangtze river basin).

[34] Clifford Warwick, *Captive breeding - saving wildlife? Or saving the pet trade?* THE ECOLOGIST (2015), https://theecologist.org/2015/sep/02/captive-breeding-saving-wildlife-or-saving-pet-trade (last visited Feb. 20, 2021).

[35] *Id.*

[36] Rob Laidlaw, *Scales and tails: The welfare and trade of reptiles kept as pets in Canada*, ZOOCHECK (2016), https://www.zoocheck.com/wp-content/uploads/2016/06/Reptile_Report_FA.pdf (last visited Feb. 20, 2021).

[37] *Id.*

[38] *Id.*

[39] *Reptile Farms and Captive Breeding No Solution to Problems*, *supra* note 12.

[40] *Why Fish Make Awesome Pets*, VET DEPOT (Jan. 7, 2016), http://blog.vetdepot.com/why-fish-make-awesome-pets (last visited Feb. 20, 2021); *Reptiles Make Great Pets*, HARTZ, https://www.hartz.com/reptiles-make-great-pets/ (last visited Feb. 20, 2021).

[41] R. Loh et al., *The Appalling State of Pet Fish Welfare*, World Small Animal Veterinary Association Congress Proceedings (2016), https://www.vin.com/apputil/content/defaultadv1.aspx?pId=19840&catId=105898&id=8249924&ind=534&objTypeID=17 (last visited Feb. 20, 2021).

[42] *Id.*

[43] *Id.*

[44] C.A. Schuppli, D. Fraser & H.J. Bacon, *Welfare of non-traditional pets*, 33 Revue Scientifique et Technique de l'OIE 221, 224 (2014).

Sadly, although companion animals are generally protected by the state anti-cruelty laws, this usually does not apply to aquatic companion animals. Sometimes these animals are excluded from the law altogether, and other times even when they are included, law enforcement officers and prosecutors do not take allegations of cruelty against them seriously, or choose not to use their limited resources to protect them. For example, depending on the state, a goldfish may not even be classified as an "animal" under the law![45]

G. What is Being Done

Fortunately, there is growing awareness of these important issues surrounding aquatic companion animals and positive steps are being taken. For instance, Rutgers University researchers have found that the most popular species of reptiles and amphibians, "those imported in high numbers and sold at low prices, usually when they're small and cute – are the most likely to be dumped into the wild later on."[46] The knowledge gleaned from this study indicates that "providing potential owners with information about the future growth and lifespan of an exotic pet, along with the ecological damage that can result from releasing them, and a list of safe places to surrender them, including shelters, rehoming initiatives and buy-back programs" can help to avoid future releases.[47]

Along these lines, the state of Florida's Fish and Wildlife Commission offers an "Exotic Pet Amnesty Program," which is "an effort to reduce the number of nonnative species being released into the wild by pet owners who can no longer care for their pets or no longer wish to keep them. Another goal of the program is to foster responsible pet ownership through outreach and education at Exotic Pet Amnesty Day events."[48]

In addition, there is growing awareness – in the both the scientific and animal protection communities, as well as in the popular media – of the sentience and biological needs of aquatic companion animals and the welfare issues they currently confront.[49] Furthermore, retailers are taking steps to reduce the sale of certain problematic products, such as beta fish tanks, and even the sale of certain live aquatic animals altogether.

H. What Can You Do?

When deciding on a companion animal, consider your choices carefully. If you do choose to keep an aquatic animal, consider the sourcing and potential impact thereof, particularly on wild populations. Remember that "there is little evidence to suggest that captive breeding of reptiles for the pet trade has resulted in significantly smaller numbers of reptiles being removed from the wild,"[50] and both wild-caught and captive-bred reptiles experience welfare problems. Particularly, think carefully about keeping reptiles as companion animals, and if you do, adopt, don't shop! Seek out a reputable rescue organization from which to adopt a reptile or other aquatic animal.

Be aware of the special needs of aquatic companion animals – don't be fooled by claims that a certain species is easy-to-keep and doesn't require much space, attention or effort. If you do keep an aquatic companion animal ensure they have adequate space, environmental enrichment, and other care unique to their species and needs. As with other companion animals such as dogs or cats, aquatic animals need special care, attention and kindness.

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[45] Nicole Pallotta, *Animal Cruelty Charges Dropped Because Fish Are Not "Animals" Under North Carolina Law*, ANIMAL LEGAL DEF. FUND (June 11, 2019), https://aldf.org/article/animal-cruelty-charges-dropped-because-fish-are-not-animals-under-north-carolina-law/ (last visited Feb. 20, 2021).
[46] *For Exotic Pets, the Most Popular Are Also Most Likely to be Released in the Wild*, *supra* note 26.
[47] *Ibid.*
[48] *Exotic Pet Amnesty Program*, FLA. FISH & WILDLIFE CONSERVATION COMM'N, https://myfwc.com/wildlifehabitats/nonnatives/amnesty-program/ (last visited Feb. 20, 2021).
[49] For example, *see* Culum Brown, *Fish Intelligence, Sentience and Ethics*, ANIMAL COGNITION, 18(1), 1-17, https://www.wellbeingintlstudiesrepository.org/cgi/viewcontent.cgi?article=1074&context=acwp_asie (last visited Feb. 22, 2021); *Reptile Pets Can Experience Poor Welfare*, ZOOCHECK, https://www.zoocheck.com/feature-campaigns-2015/exotic-pets/reptile-and-amphibian-issues/reptile-pets-experience-poor-welfare/
[50] *Reptile Farms and Captive Breeding No Solution to Problems*, *supra* note 12.

Additional Resources on this subject can be found in our "Resources" section below. Furthermore, this topic was dealt with in our 2020 Resource Packet.

3. Aquatic Animals in Entertainment

A. Introduction

Captive aquatic animals provide entertainment to humans at marine parks, aquaria, and other facilities throughout the world. Dolphins, whales, and other cetaceans perform tricks in shows. Throngs of tourists head to these facilities for the opportunity to have their photos taken with dolphins – or even to swim or otherwise interact with them. Countless more aquatic animals are on public display in tanks or ponds where they swim endlessly back and forth in front of crowds, noise, and flashing lights. Even other aquatic animals such as polar bears, seals, otters, manatees and many more, are kept at both zoos and aquaria around the world, some for the entirety of their lives! Although these marine parks, aquaria, zoos, and other facilities make representations to the public that the welfare of these aquatic animals is their utmost concern, these captive aquatic animals nonetheless suffer – physically, psychologically, and otherwise.

Additional areas in which aquatic animals are used for "entertainment" may not be as obvious, such as recreational fishing. However, recreational fishing has a major impact on aquatic life and ecosystems, even "catch and release" fishing, which may at first seem harmless, and is mistakenly advertised as such.

Aquatic animals are also widely utilized in television, movies, media and other outlets purely for entertainment value. These utilizations and impacts are vast, and far reaching – well beyond the species that are kept in these facilities. Highlighted examples of these uses and impacts have been included in this section below.

B. Marine Mammals in Captivity

Although the public display of dolphins and whales in aquariums and marine parks is "waning in Europe and Canada," it remains widespread in the United States and "is increasing in developing countries, particularly those in Asia."[51]

[51] *Marine mammals in captivity*, THE HUMANE SOC'Y OF THE U.S., https://www.humanesociety.org/resources/marine-mammals-captivity (last visited Feb. 20, 2021).

Marine parks keep various species of marine mammals captive in concrete tanks, particularly dolphins and whales. However, the "very nature of" dolphins and whales "makes them uniquely unsuited to confinement." Captive dolphins and whales live very different lives from their wild counterparts. Life in a barren concrete tank is "nothing like a life in the sea."[52]

In captivity, it is nearly "impossible to maintain a family group as animals are frequently traded among different facilities. In a tank, the environment is monotonous and limited in scope"; this unnatural life in a tank can also cause skin problems and dorsal fin collapse in orcas.[53] And while orcas in the wild "exist in tight-knit family groups and can travel over 100 miles in a single day, captive orcas are kept in small pools for entertainment, in which they cannot dive and must swim circles in shallow tanks."[54]

Although some species of marine mammals such as seals and sea lions "may breed readily in captivity, only a few species are held in numbers large enough to sustain a breeding population."[55] In contrast, some species of dolphins and whales, "do not breed well in captivity and some have never produced surviving offspring."[56]

Not only does taking marine animals from the wild harm the individual animals themselves, "but capturing them from the wild and forcing them to live in captivity for entertainment purposes has a serious impact on natural marine ecosystems. Taking a single dolphin or whale from a pod can completely disrupt the pod's function."[57] Over 145 orca whales have been forced into captivity over the lifespan of the whale captivity; almost 90 % of these whales have died.[58] In captivity, the average orca lives only about four or five years – in contrast, orcas can live to be 90 years old in the wild![59] In fact, "many of the captive dolphins and whales have shorter life expectancy than others of their species who still live in the wild."[60]

[52] *Id.*
[53] *Id.*
[54] *Animals in Entertainment,* ANIMAL LEGAL DEF. FUND, https://aldf.org/issue/animals-in-entertainment/ (last visited Feb. 21, 2021).
[55] *Marine mammals in captivity*, *supra* note 51.
[56] *Id.*
[57] *The 10 Biggest Threats Marine Mammals Face Today*, ONE GREEN PLANET (2014), https://www.onegreenplanet.org/animalsandnature/biggest-threats-marine-mammals-face-today/ (last visited Feb. 20, 2021).
[58] *Id.*
[59] *Id.*
[60] *Marine mammals in captivity*, *supra* note 51.

Captive dolphins are also "commercially exploited in … 'swim-with-the-dolphins' (SWTD) attractions" around the world.[61] Supporters of SWTD maintain that these attractions provide "educational, recreational and therapeutic motivations and benefits."[62] But SWTD programs are harmful and dangerous to the dolphin and human participants:

> Captive dolphins may exhibit an assimilation tendency, expecting humans to fulfill the natural social roles of their wild counterparts. They may become submissive or sexually aggressive when interacting with humans. Dolphins in SWTD programs have demonstrated agitated and aggressive behavior under the stressful conditions of forced interaction. These behaviors may result in serious physical injury to swimmers. SWTD programs have reported human injuries including lacerations, tooth rakes, internal injuries, broken bones, and shock. There is the potential for dolphins to suffer from unnatural exposure to human bacterial and viral infections, and they have experienced stress-related conditions, including ulcers.[63]

Relatedly, some SWTD programs offer "dolphin-assisted therapy" (DAT) for both adults and children with conditions such as cerebral palsy, autism, Down's Syndrome, spinal and head injuries, and cancer.[64] Although proponents of DAT tout its therapeutic effect, "there is no evidence that interacting with dolphins has any greater therapeutic effect than interacting with domesticated animals, such as puppies, kittens, or farm animals."[65]

Notably, no federal laws ban the display of orcas in captivity – "in fact the Marine Mammal Protection Act allows the capture of wild orcas for the purposes of 'education' and entertainment."[66] The parks, aquariums, and other facilities that "charge the public to see and interact with whales and dolphins in captivity" claim that public display of these animals "serves educational and conservation purposes. However, experience has proven that public display does not effectively educate the public who generally learn little of value about the animals that are on display in shows and swim-with facilities."[67]Likewise, the impact of these programs on conservation is quite negative.

Efforts have been made to use the legal system, with mixed results, to help protect these animals, to improve their welfare, to have them relieved from participating in certain activities, and even to have them released. One example is Sk'aliCh'elh-tenaut (also known as Lolita or Tokitae), and orca who has been kept at the Miami Seaquarium, in the smallest orca tank in the world, for over 50 years. Advocates used the federal Endangered Species Act to argue for protections for this orca. In 2018 the 11th U.S. Circuit Court of Appeals in Miami rejected this claim. However, there are ongoing efforts and further legal actions working to free her, including the use of the Native American Graves Protection and Repatriation Act (NAGPRA) by the Lummi Nation.

C. Fish and Aquatic Animals on Public Display

Public display of aquatic animals other than marine mammals is also problematic. Confined in comparatively small tanks, fish and other aquatic animals in aquaria, or even zoos with tanks, "can get bored and frustrated. In an effort to provide more natural environments for the animals, different species are often kept together, which lead to predatory animals attacking or eating their tank mates."[68]

Because aquaria "make a profit from displaying animals, they put their commercial interests above animals' needs."[69]

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[61] *Swim-with-the-dolphins attractions*, THE HUMANE SOC'Y OF THE U.S., https://www.humanesociety.org/resources/swim-dolphins-attractions (last visited Feb. 21, 2021).
[62] *Id.*
[63] *Id.*
[64] *Id.*
[65] *Id.*
[66] *Animals in Entertainment*, *supra* note 54.
[67] *Marine mammals in captivity*, *supra* note 51.
[68] Doris Lin, *What's Wrong With Aquariums?,* TREEHUGGER (July 28, 2019), (last visited Feb. 21, 2021).
[69] *Aquaria and Marine Parks*, PETA UK, https://www.peta.org.uk/issues/animals-not-use-entertainment/aquaria-marine-parks/ (last visited Feb. 21, 2021).

> For example, shy fish – who, in the wild, would spend much of their time hiding in rock crevices or among seaweed to escape predators – are kept in barren tanks with no place to hide so that human visitors can get a better look at them. Investigations have also revealed that animals are forced to live with incompatible species (for example, diurnal and nocturnal fish are kept in the same tank) and kept in tanks that are far too small for them or that have no enrichment. Rays may be kept in shallow tanks that visitors can dip their hands into, while some "star attractions" are carted around the country every few months to different aquaria. Unsurprisingly, animals in aquaria often exhibit stereotypic behaviour, such as swimming in circles or repeatedly breaking the surface of the water.[70]

Moreover, aquarium tanks "are stocked either with captured animals or animals bred in captivity. Capturing animals in the wild is stressful, injurious and sometimes fatal; breeding in captivity is also a problem because those animals will live their entire lives in a tiny tank instead of a vast ocean."[71] And in-breeding is common due to the limited number of individuals within the zoo/park/aquarium setting, which causes further problems for the animals' welfare.

D. Recreational Fishing

Recreational fishing is the "fishing of aquatic animals (mainly fish) that doesn't constitute the individual's primary resource to meet basic nutrition needs and are not generally sold or otherwise traded on export, domestic or black markets."[72] Although rough estimates of the number of recreational fishers around the world "vary widely from a minimum of 220 million to a maximum of 700 million … participation in recreational fishing is increasing on a global scale, particularly in developing nations in accordance with the expansion of the middle class."[73]

Some recreational fishers practice "catch and release" fishing – in which fish are caught for fun and then returned to the water – believing that this practice is harmless to the fish, as well as good for conservation.[74] After being caught and released by a fisher, the fish can die for a multitude of reasons:

> The most common causes of death are the physiological stresses caused by the struggle during capture and injuries caused by the hook or the angler. Some fish may die even though they appear unharmed and despite efforts at revival. Fish that struggle intensely for a long time during capture are usually exhausted and stressed from the accumulation of excessive amounts of lactic acid in their muscles and blood. Severe exhaustion causes physiological imbalance, muscle failure, or death.[75]

In addition, these fish frequently swallow fishing hooks, and fishers "may try to retrieve a hook by shoving their fingers or pliers down the fish's throat, ripping out not just the hook but some of the fish's throat and guts as well."[76] We know that fish feel pain,[77] and "hooked fish struggle out of fear and physical pain, desperate to breathe."[78] Another

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[70] *Id.*
[71] Doris Lin, *What's Wrong With Aquariums*, *supra* note 68.
[72] *The role of Recreational Fisheries in the sustainable management of marine resources*, FOOD & AGRIC. ORG. OF THE UNITED NATIONS, http://www.fao.org/in-action/globefish/fishery-information/resource-detail/en/c/1013313/ (last visited Feb. 21, 2021).
[73] *Id.*
[74] Per NOAA Fisheries, "Catch and release is a great conservation strategy." *Catch & Release Best Practices*, NOAA FISHERIES, https://www.fisheries.noaa.gov/national/resources-fishing/catch-and-release-best-practices (last visited Feb. 21, 2021).
[75] *Techniques to Reduce Catch-and-Release Mortality*, FLA. FISH & WILDLIFE COMM'N, https://www.fisheries.noaa.gov/national/resources-fishing/catch-and-release-best-practices (last visited Feb. 21, 2021).
[76] *Animal Rights Uncompromised: Catch-and-Release Fishing*, PETA, https://www.peta.org/about-peta/why-peta/catch-and-release-fishing/ (last visited Feb. 21, 2021).
[77] Ferris Jabr, *It's Official: Fish Feel Pain*, SMITHSONIAN MAGAZINE (Jan. 8, 2018), https://www.smithsonianmag.com/science-nature/fish-feel-pain-180967764/ (last visited Feb. 21, 2021).
[78] *Animal Rights Uncompromised*, *supra* note 76.

problem with catch and release activities is that the protective layer on a fish's body is disturbed when handled – this "and other injuries make fish easy targets for predators once they are returned to the water."[79]

Catch and release can also *cause* several conservation issues, including "high stock exploitation, selective harvest of 'trophy fish' (and therefore shifts in population structure), habitat destruction, unwanted catch and release mortality/disease, introduction of non-native species and disturbance of the environment."[80]

An additional aspect of recreational fishing that is problematic is the use of "baitfish". As the name suggests, these are the smaller fish who are used to catch the bigger fish. Estimates show that in the USA alone, 1 to 10 billion farmed baitfish are sold annually. There are no legally mandated welfare protections for these animals in their breeding, transportation, or use.

Similar to commercial fishing, fishing gear from recreational fishing can be harmful to other wildlife. Each year, recreational fishers "leave behind a trail of tackle victims that includes millions of birds, turtles, cats, and other animals who suffer debilitating injuries after they swallow fishhooks or become entangled in fishing line. Wildlife rehabilitators say that discarded fishing tackle is one of the greatest threats to aquatic animals."[81]

E. What is Being Done?

Throughout the world, people are coming to the realization that marine mammals, including dolphins and whales do not belong in captivity and law are being developed to protect them. Canada no longer allows beluga whales to be captured and exported.[82] France no longer allows captive breeding of dolphins and killer whales.[83] Mexico City has banned the use of marine mammals in "shows, therapy sessions and scientific experiments," while India will "no longer permit dolphins to be kept in captivity for entertainment, stating that to do so would be 'morally unacceptable.'"[84] The importation of dolphins for use in entertainment has been banned in Israel.[85] In the United States, animal protection organizations like the Animal Legal Defense Fund are using the legal system to advocate for stronger protections for animals in entertainment, including orcas.[86] In 2016, California became the first state to ban the breeding of orcas in captivity, or their use in theatrical shows; orcas "already in captivity may remain in the state, but they can only be used for 'educational presentations.'"[87]

F. What Can You Do?

Anyone can make kinder choices that can impact on aquatic animals and their welfare. One example is to not support marine parks, aquariums, zoos, or facilities where aquatic animals are kept in captivity. One can also avoid tourism, hospitality providers, and cruise lines that offer harmful attractions, such as SWTD. A more direct approach is to actively contact these facilities and share your views regarding their activities, for example that tourism should not be cruel and should not depend on the commercial exploitation of marine mammals. Another avenue could be to contact your elected representatives and urge them to support an amendment to the Marine Mammal Protection Act prohibiting the capture of marine mammals from the wild for public display during the Act's next re-authorization. One might

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[79] *Id.*
[80] *The role of Recreational Fisheries, supra* note 72.
[81] *Animal Rights Uncompromised, supra* note 76.
[82] Amy Held, *Canada Bans Keeping Whales And Dolphins In Captivity*, NPR (June 11, 2019), https://www.npr.org/2019/06/11/731570415/canada-bans-keeping-whales-and-dolphins-in-captivity (last visited Feb. 21, 2021).
[83] *France Bans Captive Breeding of Dolphins And Killer Whales*, BBC NEWS (May 7, 2017), https://www.bbc.com/news/world-europe-39834098 (last visited Feb. 21, 2021).
[84] *Marine Animal Exhibits: Chlorinated Prisons*, PETA, https://www.peta.org/issues/animals-in-entertainment/animals-used-entertainment-factsheets/marine-animal-exhibits-chlorinated-prisons/ (last visited Feb. 21, 2021).
[85] *Id.*
[86] *Animals in Entertainment, supra* note 54.
[87] Madison Park, *California bans killer whale theatrical shows, breeding*, CNN (Sept. 14, 2016), https://www.cnn.com/2016/09/14/us/orca-killer-whales-california-ban (last visited Feb. 21, 2021).

also opt out of recreational fishing, and instead enjoy other outdoor activities, such as hiking, camping, and canoeing that do not involve killing or utilizing aquatic animals.

Additional Resources on this subject can be found in our "Resources" section below. Furthermore, this topic was dealt with in our 2020 Resource Packet.

4. Aquatic Animals in Fashion, Clothing and Décor

A. Introduction

The fashion and home décor industries impact aquatic animals and their habitats heavily, in ways that are relatively unknown or even surprising. For example, the use of down feathers and otter fur in winter garments, or chemical treatments and synthetic microfibers that find their way into water supplies, contributing to a number of physical and chemical harms affecting aquatic animals.

Other ways that aquatic animals are directly harmed include killing them for jewelry (for example pearls that are used in a variety of jewelry) and decorations (such as shells) – and a variety of other purposes.

Highlighted examples of these uses and impacts have been included in this section below.

B. Aquatic Birds

Aquatic birds, including waterfowl such as geese and ducks, are used for their down feathers, the soft layer of feathers nearest the animals' skin. Down is desirable in the industry because of its high warmth-to-weight ratio, and is often sold as a byproduct of the meat and foie gras industries. Feathers are sometimes "live-plucked" from the animals, which some equate to a human having her hairs pulled out. Brands like Patagonia, North Face, and Canada Goose have focused efforts on ensuring their down is ethically sourced, saying this leads to better quality down, too. Some say animal welfare groups contend this is not enough, and "[t]he only way to reduce animal suffering is for retailers to go for synthetic" materials, with newer technology allowing companies to be "innovative as well as compassionate."

C. Fur-Bearing Aquatic Animals

When people think of animals used for their fur, they tend to think of land animals, yet a large number of aquatic animals are also utilized for their fur. For example, sea otters continue to be exploited in this way a federal moratorium on taking protected marine mammals. Sea otters were once hunted to near extinction for their prized skins of dense fur, composed of more than a million hairs per square inch, until the Treaty for the Preservation and Protection of Fur

Seals in 1911. The very names of these animals problematically indicates the use for which humans think they are best suited.

The Marine Mammal Act of 1972 prescribed the U.S. government's responsibility to conserve marine mammals, including the sea otter, walrus, polar bear, cetacean and pinniped populations. The act was amended to permit Indians, Aleut, and Eskimos[88] on the North Pacific coast to hunt marine mammals so long as the hunting is "conducted for the sake of subsistence or for the purpose of creating and selling authentic native articles of handicraft and clothing." As a result, one member of the Yup'ik tribe in Sitka, Alaska, revived the modern use of sea otter pelt with Shaman Furs and stated its "mission to reintroduce style to the allure of sea otter." The hunter-turned-designer has access to a "luxury good" – sea otter pelt – that other high-end brands do not, which he uses to create and sell hats, vests, earrings, and pencil skirts from sea otter and seal skins, earning $1,500 for a skirt and $5,500 for one blanket. There are a number of "seal hunts" that happen across the world, where seals are killed for their fur, including in Canada, Namibia, and Greenland.

Aquatic animals such as alligators and crocodiles (and even certain snakes) are also captured or farmed for their skins. These skins are considered exotic leather and are used for a number of products including shoes, boots, belts, wallets, handbags and other items.

D. The Fashion Industry

Byproducts of the fashion industry also harm aquatic animals, with significant amounts of water consumed in production and the dyed, chemically-treated wastewater contributing to water pollution. The industry stands out among other manufacturing industries as having one of the largest "water footprints," or the amount of freshwater used and polluted during production, consuming 2,700 liters of water to make a single cotton shirt. Garment production accounts for up to twenty percent of industrial water pollution, with textile dyes, treatments, and thousands of synthetic chemicals regularly released into freshwater sources.

The damage to aquatic environments does not stop at garment production: machine washing synthetic materials also creates harmful outputs that often end up in the water supply. Machine washing synthetic fabrics releases harmful microfibers which enter rivers, lakes, and oceans. These artificial microfibers are now "ubiquitous" in aquatic environments, and their effects felt by aquatic animal populations. Microfibers, like microplastics, directly and indirectly harm marine life who ingest them, causing physical and chemical effects as well as starvation and reproductive harms. Though the full effects remain unknown, microfibers have also been found in marine species consumed for food by humans.

Additional Resources on this subject can be found in our "Resources" section below. Furthermore, this topic was dealt with in our 2020 Resource Packet.

[88] Though this terminology can be seen as pejorative it is utilized as per U.S. Fish and Wildlife Services Government Website: "Digest of Federal Resource Laws of Interest to the U.S. Fish and Wildlife Service" https://www.fws.gov/laws/lawsdigest/MARMAM.HTML.

5. Use of Aquatic Animals in Scientific and Biomedical Research and Medicine

A. Introduction

Aquatic animals are routinely used in the name of medicine, with some scientists seeing the diversity of aquatic life as an opportunity for innovative developments in human medicine. Fishes and other aquatic animals are increasingly being used in scientific and biomedical research. Most scientific studies are conducted in laboratories while others are field observation in natural environments. The focus, while using fishes and other aquatic animals, is primarily the search for potential *human* benefits, rather than science that will help these other animals. It is estimated that fishes make up seven percent of animals used in laboratories, which equates to millions of animals used every year.

It is clear that the use of certain aquatic animals, like zebrafish, is rising exponentially. However, the true numbers cannot be known because the United States Department of Agriculture does not count them in its reporting. Despite their widespread use, fishes and certain other aquatic animals are not protected by either the Animal Welfare Act or the Humane Methods of Slaughter Act. Highlighted examples of these uses and impacts have been included in this section below.

B. Testing on Aquatic Animals

In some research initiatives, fishes have replaced mammals and other animals, sometimes in an effort to "reduce animal testing." But it is an open question whether they are needed at all as there is some evidence that human tissue and organ cultures and computer modeling can replace some live fish experiments. Though some scientists are still of the view that "[t]here are many instances when it is not possible to replace live fishes in experiments." Some especially controversial lethal studies have been carried out on endangered or protected species, which "are likely only be justified if the conservation benefit … out-weighs the cost to the individuals." Other scientists believe that it is no longer necessary to use animal models in toxicological, and some other types of research.

The American Fisheries Society created its *Guidelines for the Use of Fisheries in Research*, which discusses suggested experimental designs and procedures, humane treatment of test animals, and ethical concerns behind the research. It indicates that research on fishes may be conducted so long as the designs and specifications of the experiments "can lead to scientifically valid results." The guide highlights some of the differences between experimenting on fish rather than mammals, saying research on fish "often requires[] much larger numbers of research subjects" because of high natural mortality rates in juvenile populations. The guide notes "the experience of pain in mammals is not experienced in fish," but it also emphasizes the importance of sedation or anesthesia. However, contrary to that view, there is significant evidence that fish do experience pain and suffer under adverse conditions, showing changes in brain activity and behavior during noxious stimuli, which are prevented by pain-relieving analgesics. In fact, there is now a scientific consensus that fish feel pain. This leads one to consider what obligations we have to reduce pain and suffering when we use these animals.

As many people become more conscious of animal sentience and our impacts on aquatic life, "intense research" is underway in both laboratories and field experiments measuring the effects of microfibers and microplastics on aquatic animals. This involves, in part, exposing fish, crustacea, and mollusks to certain amounts of different plastics in controlled laboratory environments. These animals experience starvation, neurotoxicity (brain damage), growth and reproductive deficiencies, and death from exposure to levels of microplastics "higher than those typically encountered in the aquatic environment."

Additionally, there is an increasing use of animals such as cephalopods, such as octopuses, in scientific research. Some jurisdictions have taken steps to limit the use of cephalopods in scientific research. For example,

> On 1 January 2013, research using any of the about 700 extant species of "live cephalopods" became regulated within the European Union by Directive 2010/63/EU on the "Protection of Animals used for Scientific Purposes", giving cephalopods the same European Union legal protection as previously afforded only to vertebrates. The Directive has a number of implications, particularly for neuroscience research.

Many pressures influence decisions made in animal-based research including those from the public, media, and politicians. Ethical considerations and the human impact on aquatic animals must be accounted for in assessing sample sizes, removing animals from the wild, and even field observations, because each of those actions disrupts animal habitats. Some members of the research community urge other researchers to minimize the number of animals used in experiments, and to make thoughtful calculations of the sample sizes needed to establish scientific efficacy. Some groups also advocate for the use of alternatives to animals in scientific research.

Many of today's most familiar aquatic animal research models were created early in the twentieth century, but according to some, "the promise of using these organisms in research is rediscovered roughly every decade." Biomedical research on marine organisms is deemed important to medicine because "the diversity of life in the sea offers more possibilities for the discovery of organisms for use as models to explore various biological processes." This diversity informs researchers on the evolution of vertebrates and mammals, and enables scientists to study complex processes more readily than they could in otherwise. However, this diversity and the differences between human and other animal physiology may also account for the slow progress in many areas of research. Some scientists suggest that the use of animal models inhibits rather than enhances the pace of medical discovery.

Various species are used in medical research, in the fields of immunology, neurobiology, cell biology, cancer research, and physiology. Scientists have found surprising similarities between some marine life and human anatomy. One of the best examples of this is the zebrafish, whose cell physiology is similar enough to humans' to be used as model for human diseases like cancer, heart disease, obesity, muscular dystrophy and narcolepsy. The last ten years brought a "boom" in zebrafish research, with twenty researchers studying 15,000 zebrafish at the University of Alabama alone. The question that arises from finding similarities is whether these animals should like us, receive protections from harm during use as research subjects, and whether they should help us have more empathy for these animals.

Some studies use sharks and other cartilaginous fishes to investigate underlying causes of diseases like lupus and rheumatoid arthritis. Tunicates, otherwise known as sea squirts, are used as models for studying self-recognition and its role in immunity, which scientists used for organ transplant and virus transmission studies. Toadfish have a comparable vestibular system to humans, lending insight to research on human balance disorders.

Fish are also used as an alternative to rodents in studying cancerous environments, with rainbow trout promoted as a model for observation of cancerous compounds and tumor development. Marine organisms, particularly horseshoe crabs, are used for research on human vision because the retinal tissue is "readily accessible and can be removed from the animal and studied in the laboratory for long periods of time." Horseshoe crabs are also widely used in vaccine development, as discussed below.

The widespread use of these animals dies not also result in a review of the environmental impacts of taking them from the wild, or the welfare implications of using animals who have human-like attributes. These questions need to be addressed.

C. Ingredients, Medical Products, Vaccines and Medications

In addition to their use in testing, horseshoe crabs are utilized widely for their unique, copper-based blue blood which contains a substance called "Limulus Amebocyte Lysate", or "LAL", and is drained out of them while they are alive. These animals have been utilized for the development of a number of medical products including vaccines, injectable medications, intravenous solutions, and implantable medical devices. This usage not only leave thousands of these animals dead every year, but has a huge impact on the environment and other animals, including shorebirds who rely on their eggs as a source of food. There are alternatives to the use of these animals.

Another example of the use of aquatic organisms in medicine is naturally occurring "adjuvants" that helped create some modern vaccines. One example of an adjuvant is squalene, named for the *Squalidae* family of sharks. Squalene is obtained from shark liver oil and most of today's product is harvested from spiny dog fish. Another potential adjuvant, chitosan, is derived from the waste of crustacean shells, including crabs, shrimps, lobsters, and krill.

A number of aquatic animals are also used in different traditional medicines across the world. One example is seahorses, who have been used in Chinese traditional medicine from time immemorial.

Additional Resources on this subject can be found in our "Resources" section below. Furthermore, this topic was dealt with in our 2020 Resource Packet.

6. Pollution and its Effects on Aquatic Animals

A. Introduction

Pollution is defined as the presence or introduction of a harmful substance into the environment. Humans have increasingly created more and more pollution of aquatic environments, which directly and indirectly impacts aquatic animals. These impacts include pollution created from activities including but not limited to oil and gas, drilling and mining, fishing, aquaculture, terrestrial animal agriculture, and other industries. Pollution from noise, sewage, beauty products such as sunscreen, and dumping are less often considered.

Like the wide range in types of pollution, there is also a significant variety of its effects on aquatic animals, as well as on their habitats and ecosystems more broadly. These impacts range from the external, such as changes in water quality, to changes in species' reproductive capacities, to physiological and biological changes in individual animals.

For purposes of this section, we have highlighted only a few examples of the types of pollution that aquatic animals are subjected to, the problems with these, and some of the ways that stakeholders are attempting to deal with them.

B. Oil and Gas

Individual oil spill events are often sensationalized and, reasonably, result in large public outcry. These accidental spills can be caused by a range of factors including storms, earthquakes, mechanical failure, or human error or negligence. However, estimates suggest that 47% of the total oil released into oceans is an ongoing part of oil production – "natural seepage" – resulting in approximately 600,000 metric tons spilled per year. Crude oil directly impacts fish, causing issues with heart development and cardiac activity. Crude oil is also made of highly toxic compounds, such as polycyclic aromatic substances and dioxins, which can affect animals' biological cues and block metamorphosis of coral reef larvae, just to name a few of the known problems.

The impacts to aquatic animals do not stop with the spills themselves. Dispersants are often used to remove oil spills by breaking down the oil and dissolving it into water. Like the crude oil components, the dispersants are also highly cytotoxic and genotoxic. These toxins bioaccumulate in animals as they rise through the food web. The dispersant used following the *Deepwater Horizon* spill in 2010, for example, was found even in sperm whale skin cells. An alternative to dispersants as a remedy is to increase hydrocarbonoclastic bacteria at the site, which results in microbial degradation of the crude oil components. Hydrocarbonoclastic bacteria require nitrogen and phosphorus, which is introduced through fertilizers such as uric acid, further changing the chemical composition of the water. Growing shipping traffic and oil and gas activities are creating new sources of heavy metals.

The U.S Oil Pollution Act of 1990 celebrated its thirtieth anniversary last year. The Act provides a way to hold companies responsible for the damages caused by oil spills, after determining the extent of the injuries and the best

recovery paths. The National Oceanic and Atmospheric Administration (NOAA) is in charge of overseeing the restoration. The Clean Water Act also allows for criminal punishments for negligent oil releases into waters of the United States. For example, following the *Deepwater Horizon* spill, BP Exploration and Production Inc. pleaded guilty to 14 criminal counts (including Felony Manslaughter, Environmental Crimes and Obstruction of Congress) and in 2013 was sentenced to pay a record US$4 billion in criminal fines and penalties.

While there are ways to "clean up" certain impacts after an oil spill disaster, these are by no means sufficient to the address the damage caused, and these "remedies" are not without their own impacts to aquatic animals and their environment. Future solutions need to focus on the prevention of spills. This responsibility falls heavily on those likely to cause spills to routinely inspect their equipment and have procedures in place to control spills as quickly as possible and consider damage to the animals as well as to the environment and economic interests.

C. Drilling and Mining

Drilling is becoming more and more prevalent as demand for oil increases, and approximately one third of the global oil production comes from offshore infrastructures. Offshore drilling creates two predominant types of waste pollution: produced water and drilling waste. Produced water contains dispersed oil, aromatic hydrocarbons and alkylphenols, heavy metals, large amounts of organic materials, particles, inorganic salts, high levels of sulfur and sulphide, and naturally occurring radioactive material that can harm aquatic animals and ecosystems. The effects of drilling waste on aquatic ecosystems vary by geographical property, water depth, and reservoir location and structure. Beyond the waste it produces, one of the most prevalent issues with offshore drilling is the repetitive depressurization and pressurization. This can alter the oxygen consumption and affect the aerobic metabolism of deep living fish.

In 2017, then-U.S. President Trump issued an executive order reversing an Obama Administration decision that ended offshore oil and gas leasing in parts of the Atlantic and Arctic oceans. In response, the Department of the Interior began efforts to open up nearly all federal waters to oil and gas exploration and extraction. Proposals were later blocked by courts, for example, the case of the Center for Biological Diversity v. Bernhardt. Earlier this year, on January 27, 2021, President Biden signed an executive order that paused new oil and gas leases in offshore waters pending a "comprehensive review and reconsideration of Federal oil and gas permitting and leasing practices" (see Sec. 208 of the executive order).

Mining has even more direct and indirect impacts on water systems. Water pollution from discharged mine effluent and seepage from tailings and waste rock impoundments can be carried into aquatic ecosystems through runoff, which will only increase with the increased precipitation events expected due to climate change. Mining waste contains high concentrations of heavy metals, which create a variety of issues for aquatic animals and their environment. These metals are carcinogens that can impact animal health and physiological behavior by attacking and damaging DNA and enzymes. Metals also bioaccumulate in the food web, increasing their concentration and toxicity. Resulting impacts to the environment from mining waste include changes in temperature, redox potential, pH, and general physiological behavior changes in animals. Acid mine drainage, created from sulfide minerals forming sulfuric acid when exposed to water and air, is also a major concern.

Internationally, the Montego Bay Convention and the MARPOL Convention are two globally-recognized agreements on the protection of the ocean, yet neither truly regulates offshore oil and gas activities. This is because most oil and gas drilling takes place within the "Exclusive Economic Zone" (EEZ), which under international law is under the jurisdiction (and thus regulatory discretion) of the coastal country. In the United States, the Environmental Protection Agency (EPA) regulations, at least to some extent, prohibit discharges from drilling operations into U.S. waters. However, there are a number of legal exemptions and exceptions - one example is that industries can petition for adaptations based on the area, industry request, or by specificities or seek outright waivers from regulation.

There are many ways that the mining industry can decrease its impact on the environment. These include system processes changes, such as reusing mining waste or changing to lower-impact mining techniques, and rehabilitating mining sites. While mining wastes on land are being addressed and remediated, aquatic ecosystems are still being highly affected, yet less addressed.

D. Individual Human Pollution

Waste from individual humans is a very large source of pollution impacting aquatic animals. This includes plastics, sewage, heavy metals, and others.

E. *Plastic*

Approximately, ten million tons of plastic are dumped into oceans annually, killing approximately one million marine animals every year. Plastic waste reaches oceans from estuaries, aquaculture, shipping and fishing activities, sewer and storm runoff, and litter or debris. Nano plastics are also a major plastic pollution issue, coming from the cosmetics industry, tire wear, and synthetic clothing. Environmental wearing of larger plastics ultimately results in microplastics, which are highly bioavailable and easily ingested by aquatic animals, bioaccumulating in the food web.

Plastics may also transport toxic pollutants, including metals such as mercury. Many of these pollutants are highly toxic to aquatic animals, acting as carcinogens, endocrine disruptors, and neurotoxins. Experiments show that microplastics can cause mortality, reduced feeding, reduced body mass, reduced metabolic rates, and increased fertilization and larval abnormalities in aquatic animals.

F. Sewage

Sewage discharge includes household, municipal, and industrial wastewater and can be treated or untreated. The effect of sewage pollution on aquatic animals depends on the level of treatment, the periodicity and volume of the discharge, and the predominant hydrographic regime governing the sites of discharge. Sewage discharges usually include freshwater, endocrine disruptors, sediments, pathogens, and nutrients. The nutrients present a number of issues, such as potential toxicity, calcification, and impacts on reproduction and growth. Increased amounts of freshwater in saltwater environments reduces salinity, affecting the aquatic organisms. Sediments can negatively affect growth and increase mortality rates of some aquatic species. Furthermore, sewage can often contain pathogens.

G. Agricultural Runoff

Agricultural runoff has long been a leading source of water quality degradation. Runoff is caused by agricultural activities such as "poorly located or managed animal feeding operations; overgrazing; plowing too often or at the wrong time; and improper, excessive, or poorly timed application of pesticides, irrigation water, and fertilizer." Agricultural pollutants include sediment, nutrients, pathogens, pesticides, metals, and salts into aquatic ecosystems. Sediment changes the opacity of water systems, clogs gills of fish, and smothers fish larvae. Sediment also often contains other pollutants, such as fertilizers, pesticides, and heavy metals, which can cause algal blooms and depleted oxygen. The most common nutrients in agricultural runoff include phosphorus, nitrogen, and potassium stemming from chemical fertilizers, manure, and sludge.

These nutrients also cause algae blooms and depleted oxygen. Confined animal feeding operations, or CAFOs, are a major source of animal waste. Animal waste from poorly managed facilities can carry pathogens, nutrients, and oxygen-demanding organics and solids into aquatic ecosystems. Overgrazing in CAFOs introduces even more issues into aquatic ecosystems; it can expose soils, increase erosion, encourage invasive plant species; destroy fish habitats, and destroy streambanks and floodplain vegetation that are necessary for water quality filtration.

If irrigation is done incorrectly, it can concentrate salts or cause erosion, cause a buildup of toxic metals, affect water quality, transport nutrients, pesticides and heavy metals, or decrease the volume of water in streams and rivers.

Additionally, pesticide chemicals are carried by runoff into aquatic ecosystems and can poison fish and wildlife, contaminate food sources, and destroy the species' habitats.

Waste, especially plastic waste, is the primary target of "reduce, reuse, recycle" campaigns. Some jurisdictions, domestic and international, are tackling plastic pollution by banning plastic bags or the use of microplastics. Eight U.S. states have banned single-use plastic bags, while a number of cities have additional plastic bag bans or fees. Other countries have enacted stricter laws; Tanzania, for example, placed a wide-sweeping prohibition on plastic bags in 2019. There are also attempts to clean up plastic debris to reuse in consumer products or as fuel. Yet, little has been done to date to reduce the manufacturing of new plastic items, something that needs to be done in order to address the problem where it starts.

There are also many ways that farmers and farming operations can prevent agricultural runoff. Management practices can help farmers reduce erosion and sedimentation, combat nutrient losses, and improve water use efficiency. Proper waste management systems allow farmers and ranchers to limit harmful waste discharges. Integrated Pest Management techniques teach farmers which site-specific crops to incorporate to encourage natural barriers and limit pesticide use. Limiting the size of these facilities also helps make waste management more effective.

Pollution from CAFOs has also been addressed through the Clean Water Act. In 2002, a federal district court responded to a citizen suit against EPA for failing to enforce adequate laws and regulations (such as NPDES permits) in state programs to prevent pollutants from CAFOs. The court acknowledged the disastrous effects of CAFOs on air, soil, groundwater, and surface water. Acknowledging that CAFO pollution can "cause fish and other aquatic organisms to die," the court mandated that the state program in that case must get in compliance with the Clean Water Act's NPDES permitting requirements.

H. Noise Pollution and Impacts

Common noise pollution of aquatic ecosystems include military sonar, shipping, offshore oil rigs, and the use of airguns in seismic oil explorations. Noise pollution can have drastic impacts on aquatic animals, many of which depend on their hearing to navigate. This results in internal injuries to muscles and organs, causing strandings and deaths. Species are migrating to avoid noise pollution, affecting mating and child-rearing patterns. Noise pollution can also cause physical damage to animals' hearing, schooling structures, cells, and immune systems.

Rather than completely eradicating all noise pollution in the oceans, governmental agencies have attempted to manage it. This includes management strategies such as maximizing noise-free intervals, re-routing shipping paths, and discovering the ideal ship speed that produces the least amount of noise. The National Oceanic and Atmospheric Administration has an "Ocean Noise Strategy" that is designed to address ocean noise over the next ten years. It includes potential solutions such as consistent national guidance for acoustic thresholds for all of NOAA's trust resources and continued mitigation development by reducing the temporal or spatial overlap of noise areas or reducing sound level at the source.

There are attempts at international cooperation in order to fight noise pollution through international conventions and agreements. The 2014 Convention on Biological Diversity, for example, encouraged parties "to avoid, minimize and mitigate...anthropogenic underwater noise" to protect marine and coastal biodiversity. There are also international partnerships dedicated to the cause; the International Ocean Noise Coalition, for example, is a group of over 150 non-governmental organizations created to help address anthropogenic ocean noise.

I. Conclusion

Pollution has incredibly harmful impacts on aquatic animals, if not only because there are so many ways that humans are polluting aquatic ecosystems. Pollution can be as small as a plastic straw making their way to the ocean or as large as the *Deepwater Horizon* oil well releasing 130 million gallons of oil into the Gulf of Mexico. However discouraging this may seem, it also means that there are various ways that individuals, companies, governments, and institutions can combat pollution. Reducing consumption of plastics is as much a matter of prevention as fighting for stricter regulations on offshore drilling. It is imperative to be aware of how many ways humans are affecting aquatic species and their environments, which will allow us to make the changes we need to in order to best protect aquatic animals.

Additional Resources on this subject can be found in our "Resources" section below. Furthermore, this topic was dealt with in our 2020 Resource Packet.

7. Anthropogenic Climate Change Impacts on Aquatic Animals

A. Introduction

Anthropogenic activities are releasing unprecedented amounts of greenhouse gas emissions into the atmosphere, resulting in the global average temperature steadily increasing and rising faster now than ever before. Higher atmospheric greenhouse gas concentrations and temperatures are causing "climate change" - the global warming of the Earth's temperature and its impact on all aspects of the climate system.

While climate change is a worldwide issue, each region is experiencing its own set of localized impacts - on humans and nonhumans alike. Every species adapts differently to changes in their environment. Not only does this require individualized solution plans, but it can also create issues with invasive species outcompeting native species.

Climate change is affecting aquatic animals in a variety of ways, harming both species and their habitats. Rising water temperatures and other environmental changes are disrupting the biodiversity, function, and biogeochemical cycles of ecosystems. If not addressed immediately, these impacts will only continue to worsen.

Climate change manifests in a variety of ways. A few of the impacts of climate change on aquatic animals are discussed below.

B. Changes in Seawater Chemistry

Climate change is largely caused by an increase in carbon dioxide in the atmosphere. Oceans act as a major sink for carbon dioxide, resulting in direct and indirect impacts on aquatic animals. Larger concentrations of carbon dioxide lower water pH, which cause ocean acidification. Ocean acidification subsequently causes calcification, deoxygenation, and hypoxia. Increased dissolved organic carbon loading into ecosystems also alters primary productivity and decreases phytoplankton biomass, leading to changes higher in the food chain.

Oxygen concentrations are also changing in aquatic environments. The temperature-dependent equilibrium oxygen concentration, which determines the rate of oxygen component transfer between air and water, is decreasing as the temperature warms. Additionally, higher anabolic activity in organisms increases oxygen consumption, which further decreases the overall oxygen balance. On the other hand, as phytoplankton biomass increases, photosynthesis rates increase, triggering higher rates of oxygen production.

C. Temperature Increases

Greenhouse gases in the atmosphere absorb and trap heat; higher concentrations of greenhouse gases are resulting in higher global temperatures. Temperature increases have very drastic effects on aquatic animals and their habitats. Temperature serves as an important cue for species' reproduction, migration, and other seasonal activities. Shifts in these cycles can influence species' growth and fitness, as well as community organization and ecosystem function. Increased temperatures also often result in increases in the prevalence of disease and parasites.

All organisms have a window of temperatures they can survive in; within this window, changes in temperature affect metabolic activities. Corals, for example, already live near the top of their thermal window and scientists predict that only 10% of tropical reefs will survive the rising temperatures by mid-century. Conversely, some aquatic species in northern habitats, such as salmon, may see temporary increases in growth with increasing temperatures. While it is possible for some fish species to relocate to places with cooler temperatures, relocation can create additional problems – such as with invasive species. As the Arctic is warming twice as fast as the global average, the livable habitat options for fish and the other aquatic animals who live there, are decreasing.

The ocean acts as a significant global heat buffer, as it stores most of the sun's energy that reaches Earth. Because water expands as its temperature increases, sea levels are rising. Sea level rise is even further exacerbated as rising temperatures melt land and sea ice. As ice melts, the salinity of the ocean is decreasing. Increased heat (and the corresponding increased energy) changes ocean circulation patterns, leading to instability in ocean currents, more frequent and intense hurricanes and typhoons, and changes in regional climate and weather patterns. Consequently, saltwater is being added into freshwater aquifers and coastal wetlands. Ice melting also has a major impact on those species that rely on it, such as polar bears.

Ocean warming is also affecting aquaculture systems, contributing to range loss and range expansion of commercial fisheries, depending on the species and sensitivity.

D. Precipitation and Drought

Climate change impacts rain patterns, altering the timing and volume of rain events. Rainfall and runoff are imperative for freshwater organism habitats; stream flow, water quality and salinity, and the existence of seasonal ponds are dependent on rainfall events. Extreme precipitation events can flood systems and result in pollution to coastal waters with runoff from sources such as agricultural fertilizers.

E. Solar UV Radiation

Temperature can impact water density, which is the cause of ocean stratification and shoaling of the ocean's upper mixed layer.[89] As ocean temperatures and stratification increase, marine organisms are exposed to increased solar visible and UV radiation. Certain organisms are more sensitive to solar UV radiation than others, changing species composition of these systems. Exactly how changes in UV radiation will affect aquatic communities, however, is still unknown.

F. International Concerns

As an important note, climate change is impacting every region of the world differently. Vulnerability of aquatic animal species and aquaculture varies depending on climatic exposures, sensitivity of the system, and adaptive capacity. There are also very important environmental justice concerns with this. Climate change is disproportionately affecting developing countries, despite them being responsible for only a minority of global greenhouse gas emissions. Moreover, developing countries contribute 90% of the global aquaculture production, causing concerns for the future of the industry.

As stated, the effects of climate change are wide-ranging and varied. While each impact discussed has its own potential solutions, mostly retroactive, below are some ways that the United States and other countries are targeting climate change at large as it impacts aquatic ecosystems.

G. Highlighted Example: United States

Sustainable management, conservation, and restoration of aquatic ecosystems are vital for species' survival. Although both federal and state laws fail to directly protect aquatic animals, other policies have been put in place in order to address climate change with the goal of alleviating present issues while preventing future problems. For example, the United States has created 1,000 marine protected area (MPA) networks, areas designed to manage and protect marine ecosystems. Many states have begun addressing greenhouse gases on a state-scale to fill in where federal policies are lacking.

Citizens, organizations, and even states are also using litigation as a way to fight climate change, going after governments and polluting companies. Although generally unsuccessful, concerned parties are suing those most responsible for climate change for their roles under a variety of claims, such as state and federal nuisance.

The Biden Administration has announced its plans to fight climate change, including re-joining the Paris Agreement. Some of President Biden's early executive actions set goals to reduce short-term global emissions and meet net-zero global emissions by mid-century or before. President Biden has also established a White House Office of Domestic Climate Policy, led by a National Climate Advisor and Deputy National Climate Advisor, as well as a National Climate Task Force. In an executive order on January 27, 2021, President Biden also committed to protect at least 30 percent of America's ocean areas by 2030 (see Sec. 216 of the executive order). This mirrors a global "30x30" call to action to protect the world's ocean. Individual states are also taking action to protect aquatic habitats within their respective jurisdictions.

H. Selected International Considerations

In 2016, countries[90] around the globe came together within the United Nations Framework Convention on Climate Change to collectively address greenhouse gas emissions mitigation and climate change adaptation. This collaborative effort became known as the Paris Agreement. The goal of the Paris Agreement is to keep the average global temperature increase below 2 degrees Celsius. According to some projections, compliance with the Paris Agreement would result in a global average change of 6.5% in the fish biomass of the most lucrative aquaculture fish species, maintaining habitat suitability and mitigating large potential decreases in biomass and aquaculture catch. Around 75% of maritime countries would benefit from global compliance; all continents except for Europe could see higher fish

[89] Increased ocean stratification also further drives climate change, as the warmer water on the surface of the ocean absorbs less carbon dioxide from the atmosphere.

[90] As of January 2021, 194 countries and the European Union have signed the Paris Agreement. 189 countries and the European Union have ratified or acceded to the Agreement.

biomass totals. However, many scientists believe that even the current pledges fall short of what the ocean and many aquatic species need.

In 2016, members from170 countries of the International Union for Conservation of Nature (IUCN) approved a resolution calling for protection of 30% of the planet's oceans by 2030. The "30x30" project will use a network of highly protected marine areas, which do not allow any destructive or extractive activities, to help ocean life adapt to climate change, become more resilient, and protect it from other threats.

I. Conclusion

Aquatic animals are just as vulnerable to climate change as land animals, if not more. Changes in the water cycle, ocean warming, and ocean acidification are just a few of the ways aquatic animals and their habitats are being impacted. Although there are national and international efforts to combat climate change, more aggressive actions are needed immediately if we want to preserve and protect aquatic species and biodiversity. These actions should be recorded in law and should apply to governments, corporations, and all relevant stakeholders responsible for harm.

Additional Resources on this subject can be found in our "Resources" section below. Furthermore, this topic was dealt with in our 2020 Resource Packet.

8. Aquaculture Impacts

A. Introduction

Aquaculture was the theme for the 2020 World Aquatic Animal Day, and thus this subject was covered in significant detail in our 2020 Resource Packet. We encourage you to read this document, as it has a comprehensive analysis of this industry, its impacts, the regulations pertaining to it and various other aspects. For this year and this section, we have provided a shorter summary of some of these impacts.

Aquaculture, namely the "farming" of aquatic species, is the **fastest growing area of food production in the world**. As the world's insatiable appetite for seafood increases, and due to the impacts of wild-caught fishing (discussed above), aquaculture is being promoted as the future of producing fish. There are a vast number of issues with aquaculture, and the regulatory framework is insufficient for dealing with some of these.

"Aquaculture or farming in water is the aquatic equivalent of agriculture or farming on land. In this regard, a broad definition of agriculture includes farming both animals and plants. Similarly, aquaculture covers the farming of both animals (including crustaceans, finfish and mollusks) and plants (including seaweeds and freshwater macrophytes)."[91]

In 2018, 82 million tons of global fish production, valued at USD 250 billion, came from aquaculture production.[92]

China has produced more farmed food fish than the rest of the world combined every year since 1991. Although its contribution has gradually decreased since the late 1990s, the great importance of Chinese aquaculture and its implications for world total fish supply are not likely to fade soon. China has remained a major fish producer, accounting for 35 percent of global fish production in 2018. Excluding China, a significant share of production in 2018 came from Asia (34 percent), followed by the Americas (14 percent), Europe (10 percent), Africa (7 percent) and Oceania (1 percent).[93]

B. Forms or types of aquaculture

There are a number of different types of aquaculture, as well as systems. For example, there is Marine-based or Ocean-based aquaculture (such as net pens, rafts, tubes and columns); and Land-based aquaculture (ponds, raceways and tanks).

C. Marine Aquaculture: Farming Species in the Open Ocean

In the USA, marine aquaculture produces numerous species including: oysters, clams, mussels, shrimp, seaweeds, and fish (such as salmon, black sea bass, sablefish, yellowtail, and pompano) to name but a few.[94]

Challenges and Issues with Marine Aquaculture

There are wide-ranging issues with marine aquaculture, and these differ according to a number of factors. A few of these challenges have been highlighted, which are by no means complete. One useful Resource is this Report entitled, the "Dangers of Industrial Fish Farming" by Friends of Earth.

Examples, from this Report, relating to the environmental risks that marine fish cage culture aquaculture, include:

i. Water Quality - the primary potential effects to water quality associated with marine cage culture include dissolved nitrogen and phosphorus, turbidity, lipids and dissolved oxygen fluxes. Usually there are no measurable effects 30 meters beyond the cages when farms are sited in well-flushed waters. Impaired water quality may be observed around farms in nearshore or intertidal habitats where flushing is minimal and at

91 http://www.fao.org/3/ca9692en/online/ca9692en.html.

92 *FAO Report, Supra Note*

93 *Ibid.*

94 *What is aquaculture?*, NOAA, https://oceanservice.noaa.gov/facts/aquaculture.html.

farms using feeds that include unprocessed raw fish rather than formulated feeds. Protection of water quality will be best achieved by siting farms in well-flushed waters.[95]

ii. Chemicals - the use of antibiotics, therapeutants and antifoulants at marine fish farms has declined greatly (up to 95%) in the last 20 years, resulting in decreased potential for secondary harmful effects of these chemicals on the marine environment. Heavy metals from feed and antifoulants are known to accumulate beneath cages but are often in low concentrations and sequestered in the sediment.[96]

iii. Marine Life - the broader ecological role of aquaculture operations within the marine environment must be considered since fish farms in the open ocean must co-exist with a host of wild organisms including phytoplankton, benthic fauna, wild fish, marine mammals and corals. If farm nutrients accumulate and persist in the water column or sediment, marine organisms can be impacted.[97]

iv. Benthic effects – the benthic zone is the ecological region at the lowest level of a body of water such as an ocean or a lake, including the sediment surface and some sub-surface layers. Excess feed and fish waste are discharged from the farms and, if they accumulate, may alter the chemical processes of decomposition and nutrient assimilation. If a fish farm is well-managed farms, it may exhibit little perturbation.

v. Biological Pollution**:** Fish that escape from aquaculture facilities may harm wild fish populations through competition and inter-breeding, or by spreading diseases and parasites. Escaped farmed Atlantic salmon (*Salmo salar*) are a particular problem and may threaten endangered wild Atlantic salmon in the Pacific Northwest.[98]

vi. Fish for Fish Feeds: Some types of aquaculture use large quantities of wild-caught fish as feed ingredients, and thus indirectly affect marine ecosystems thousands of miles from fish farms.[99]
A recent study showed that approximately 1.2 trillion aquatic animals are fed to other aquatic animals each year. This is approximately one-third to one-half of all animals fished.[100]

vii. Organic Pollution and Eutrophication: Some aquaculture systems contribute to nutrient loading through discharges of fish wastes and uneaten feed. Compared to the largest U.S. sources of nutrient pollution, aquaculture's contribution is small, but it can be locally significant.[101]

viii. Chemical Pollution: A variety of approved chemicals are used in aquaculture, including antibiotics and pesticides. Chemical use in U.S. aquaculture is low compared to use in terrestrial agriculture, but antibiotic resistance and harm to nontarget species are concerns.[102]

ix. Habitat Modification**:** Marine aquaculture spreads over expansive marine hectares meaning that some facilities attract marine predators and can harm them through accidental entanglement or intentional harassment techniques.[103]

Additional harmful impacts and challenges may include:

i. Other forms of pollution, ranging from pesticides & insecticides; antibiotics; pharmaceuticals & agricultural drug residues; fish waste (untreated); dry pellet feed & excess feed; PCBs & Dioxins; copper sulfate to keep algae off nets; anti-foulants; microplastics.

ii. Animal Welfare Requirements: relating to feed; environmental enrichment; stunning or humane slaughter; overcrowding; infighting; Injury & Death; Stress & Depression; deformation (including deafness/ hearing); suffocation; food withdrawal; waste; disease; parasites and pests (such as sealice); and others.

iii. Negative ecosystem impacts – other potentially negative ecosystem impacts include
- Negative impacts on wild populations
- Migration
- Genetics

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[95] Carol Seals Price and James A. Morris, Jr., *Marine Cage Culture & The Environment* at 5, NOAA (Dec. 2013), https://www.noaa.gov/stories2013/pdfs/2013_PriceandMorris_MarineCageCultureandTheEnvironment(5).pdf .
[96] *Ibid.* .
[97] *Ibid.*.
[98] *Marine Aquaculture in the United States*, PEW OCEANS COMMISSION at 6, https://www.iatp.org/sites/default/files/Marine_Aquaculture_in_the_United_States_Enviro.pdf.
[99] *Ibid.*
[100] Aquatic Life Institute: "Blue Loss" https://drive.google.com/file/d/1qfCGGpCtM_vmNHa9gy-dpMGfHH9GRZ23/view
[101] *Supra Note 98.*
[102] *Ibid.*
[103] *Ibid.*

- Biodiversity
- Escapement

iv. Worker safety issues

Some of these issues apply equally to land-based systems, described below.

D. Land Based Aquaculture

The mainstay of U.S. land-based aquaculture is the production of channel catfish, which occurs largely in earthen ponds in southeastern states, and oysters, which occurs in coastal areas.[104]

Some of the benefits of land-based fish farming systems that are suggested by industry supporters include minimized threats of cultured fish escaping and competing with wild populations, improved control of diseases and parasites, true management of water quality (temperature, oxygen rate, nutrient and suspended solids content), and better control of nutrient releases to the environment. However, each of these claims is contested by others.

Some of the specific land-based aquaculture system challenges include high capital costs, increased energy demand and operational costs, and potential for rapid chemistry alterations, which requires continuous monitoring. The three main types of land-based aquaculture production systems in use include:

i. Recirculating aquaculture system (RAS) – Closed systems, commonly tank based, in which water is processed to remove suspended solids and nutrients and re-used. These systems have high energy use for pumping and filtering water, but are typically modular, and hence, are scalable and can be located nearly anywhere, including urban environments.[105]
ii. Flow-through systems (FTS) – These commonly take the form of raceways or tanks with a one-time flow through of water with varying degrees of input and output water treatment methods. Water sources include river flows, well water, or water pumped from a nearby coast. Compared to RAS, water use is high and nutrient releases are more challenging to control but pumping energy needs are typically reduced.[106]
iii. Pond systems – Possibly the earliest and most natural form of LBA, these consist simply of earthen or lined ponds or ditches, often using ecological processes to manage water quality.[107]

E. Legal Challenges

i. Introduction

Despite many of these issues, the law does not do enough to combat or effectively manage them. Oftentimes, the law promotes these practices. One example is the recent Executive Order by then President Trump, entitled "Promoting American Seafood Competitiveness and Economic Growth".[108]

In terms of the most common legal issues for biodiversity-based and environmental harms and challenges associated with aquaculture, these include:

- Conflict between the Public Trust Doctrine (PTD) and Property rights. The PTD is the principle that certain natural and cultural resources are preserved for public use, and that the government owns and must protect and maintain these resources for the public's use. The doctrine's most frequent application is to bodies of water.[109] Generally, the PTD also prevents individual property from extending to the ocean.[110] This in turn

[104] *Land-Based Aquaculture*, OREGON DEP'T OF ENVIRONMENTAL QUALITY, http://www.oregon.gov/deq/FilterDocs/PEF-Aquaculture-ExecutiveSummary.pdf.
[105] *Ibid.*
[106] *Ibid.*
[107] *Ibid.*
[108] https://www.federalregister.gov/documents/2020/05/12/2020-10315/promoting-american-seafood-competitiveness-and-economic-growth
[109] *Public Trust Doctrine*, LEGAL INFORMATION INSTITUTE, https://www.law.cornell.edu/wex/public_trust_doctrine.
[110] *Ibid.*

may be seen as a conflict with the desire for individual autonomy and security (private property rights) and the demands of public goals found in environmental protection and conservation laws. The PTD has not prohibited zoning of coastal and offshore areas. It gives significant latitude to new aquaculture activities because the siting of aquaculture-based activities offshore would require greater level of protection of the property and fish as compared to traditional forms of fishing. If the PTD is applied, operators of aquaculture operations will face the task of showing that their farms do not cause enough environmental damage that courts should restrict their operations.[111] The same PDT test is not applied to wild caught fishing operations.

- Currently, there is not a mechanism for aquaculture operators to guarantee or lease rights to the water column and associated bottom areas within and upon which the aquaculture cage/net/pen will reside. Leasing of public lands in the Exclusive Economic Zone has been limited to oil and gas exploration activities. Some suggest that this should be expanded to aquaculture activities because of the sheer space available.[112] However, it is important to note that environmental assessments should consider seriously not only the additional harms, but the cumulative impacts, of additional degradation of the waterways.

ii. Attempting to manage some of the harms and challenges[113]

Recognizing the major impacts and problems with the practice of aquaculture, the industry is utilizing certain technologies and practices in an attempt to prevent or mitigate these environmental problems. Some of these include:

1. Developing strong effluent guidelines for aquaculture under the Clean Water Act;
2. Supporting National Marine Fisheries Service and Fish and Wildlife Service activities under the Endangered Species Act to protect wild Atlantic salmon;
3. Establishing an environmentally protective permitting program for offshore aquaculture;
4. Improving state oversight of aquaculture;
5. Championing research and development investments and cost-share incentives for sustainable aquaculture practices;
6. Establishing a federal approval process for transgenic fish that mandates environmental protection;
7. Supporting market incentives for environmentally sound fish-farming;
8. Developing bilateral agreements with Canada to study and to minimize the impact of salmon-farming on wild salmon stocks.

However, even with these efforts, aquaculture still results in significant harmful impacts on animals and their environments. Harmful impacts also affect humans directly – from those working in these facilities to consumers. There is insufficient regulation, oversight, monitoring, and control of these operations to increase their numbers and to be satisfied with the status quo. The regulatory framework needs to be addressed and improved, and should include at least minimal provisions aimed at combatting these problems.

9. Wild Caught Fishing Impacts

A. Introduction

According to the United Nations Food and Agriculture Organization (FAO),[114] global fish production is estimated to have reached about 179 million tons in 2018. There are two predominant ways aquatic animals are sourced to be utilized as food - wild caught fishing and aquaculture. Highlighted examples of these uses and impacts have been included in this section below.

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[111] Mark Dowie, The Public Trust Doctrine, INST. FOR AGRIC. AND TRADE POLICY (Sept. 2004), https://www.iatp.org/sites/default/files/Public_Trust_Doctrine_Will_a_doctrine_from_the.pdf.
[112] *Federal Offshore Lands,* BUREAU OF OCEAN ENERGY MANAGEMENT, https://www.boem.gov/Federal-Offshore-Lands/.
[113] *Ibid.*
[114] *FAO. 2020. The* State of World Fisheries and Aquaculture 2020. Sustainability in action. *Rome. https://doi.org/10.4060/ca9229en*

A third of commercial fish stocks are being harvested at biologically unsustainable levels and 90 percent are fully exploited, according to the FAO. The population of Pacific bluefin tuna, for instance, has plunged 97 percent from historic levels due to rampant overfishing of one of the ocean's most ecologically and economically valuable top predators.[115] "Seventy-five percent of fisheries are overfished," says marine biologist Enric Sala. "If nothing changes, all fisheries will have collapsed by 2050." The solution, says Sala—a National Geographic Society fellow—is involving all levels of society, from consumers to policy makers. Meanwhile, bycatch continues to further deplete our oceans of wildlife, while ghost nets, plastic pollution, and the impacts of shipping choke local ecosystems. However, governments continue to provide harmful subsidies and other support to these industries, that essentially promote overfishing and various other harms - while consumers are left in the dark. If urgent action is not taken soon, much of the marine life on the planet faces a death sentence before the end of this century.

B. Examples of Fishing Methods

It is important to understand the different wild-caught fishing methods used, as well as the differences between these and their impacts – for both the targeted animals, and others.

i. Nets

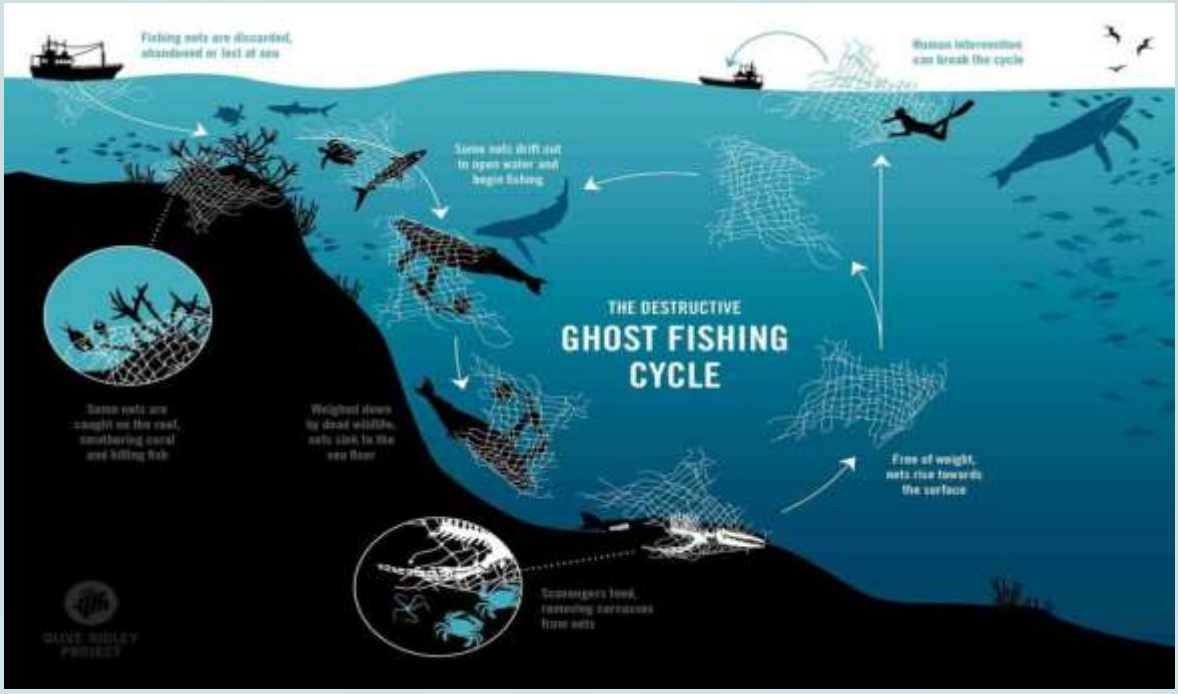
Over 80% of fish are caught with two different types of nets**: Purse Seine** fishing and **Trawling**. Purse Seine fishing is the most common way fish are caught, where a net is used like a drawstring bag, to pull fish out the water and on board. First, a school of fish are located and targeted; then, using either a crane or small boat, one end of the net encompasses and captures the school; where they are then lifted on to the fishing vessel. Because purse seining targets a particular school of fish after it has been located, bycatch (i.e. the non-target or unwanted species) is lower than fishing with trawlers.

Comparatively, when fish are trawled, instead of tossing a net around a previously located school of fish, the boat without discretion or care, drags the net behind the boat for a period of time – substantially catching **everything (and everyone)** in its way. Trawling involves weighing a net down to the seafloor then dragging it across the bottom to scoop up fish and aquatic species - one of the most disastrous methods of fishing, wreaking havoc on marine habitats and nonhuman animals alike.

[115] *National Geographic* The Sea is Running Out of Fish Despite Nations Pledges to Stop: https://www.nationalgeographic.com/science/article/sea-running-out-of-fish-despite-nations-pledges-to-stop#:~:text=%22Seventy%2Dfive%20percent%20of%20fisheries,says%20marine%20biologist%20Enric%20Sala .

Less commonly used **gillnets** are net walls with holes in them used to trap fish. Bycatch numbers are high, although these are used on a smaller level and don't require a boat with a big engine.

Ghost **Nets** are a major source of marine pollution. Studies such as this one, show that up to a million tons of ghost fishing nets enter the oceans each year. "Ghost nets are commercial fishing nets that have been lost, abandoned, or discarded at sea. Every year they are responsible for trapping and killing millions of marine animals including sharks, rays, bony fish, turtles, dolphins, whales, crustaceans, and birds. Ghost nets cause further damage by entangling live coral, smothering reefs and introducing parasites and invasive species into reef environments"[116]



The above picture, taken from Olive Ridley Project, depicts the Destructive Ghost Fishing Cycle

Long Lines are fishing lines up to miles long that have a hook every few feet. Issues in longlining are more common in fisheries close to the surface where seabirds, sharks, turtles and other animals get caught eating baited hooks. Regulations are better in higher capacity countries where fishery managers can require specialized hooks and weights that reduce bycatch. Bycatch in longline fisheries is highly variable depending on the fishery. Longlines meant to harvest tuna catch approximately 20% bycatch.

Pole and Line fishing, is where a fishing pole and line catches fish individually. There is little to no concern over bycatch for this method.

ii. Harvesting Shellfish

Dredging is similar to bottom trawling, but instead of a net, a metal rake of sorts is dragged across the bottom to collect shellfish and bivalves buried in the substrate, e.g. scallops, clams, or mussels. Traps and pots are also used to catch invertebrates like crabs and lobsters. Traps or pots are dropped to the bottom with bait intended to attract these animals. Once they crawl inside, they can't escape and are pulled back to the surface when the fishers return.

C. Non-target Victims

i. Introduction

[116] *Oliver Ridley Project*. What Are Ghost Nets: https://oliveridleyproject.org/what-are-ghost-nets#:~:text=Ghost%20nets%20cause%20further%20damage,killing%20species%20with%20economic%20value.

There are a plethora of other issues with wild-caught fishing, that fall outside the scope of this Resource Packet. However, it is important to note that regardless of who the particular target species are, wild-caught fishing impacts the entire ecosystems and various other species – whether in marine habitats or fresh water habitats. Some of these impacts and can have a much longer lasting impact – such as ghost nets, or even the plastic from the plastics that make up most of the nets in the oceans today take around 600 years to break apart.[117]

Gear sometimes gets swept away, and fishers leave their traps. This can lead to whale entanglements among other issues, such as pollution. Entanglements can also occur from other types of fishing, such as octopus fishing, leading to injuries and fatalities of non-subject species.

ii. Selected Example: Bycatch

> "Much of the fishing industry targets specific species for capture. Unfortunately, other animals become hooked or trapped when attracted to the bait or target catch, or are simply unable to avoid capture or entanglement in fishing gear. One of the most widely publicized examples of bycatch occurred during the 1970s, when thousands of dolphins perished in tuna purse seine nets in the Pacific.
>
> Although actions have since been taken, such as restrictions on the use of certain fishing methods, and other legislative and policy measures implemented, bycatch is still a tremendous problem in all fisheries and in all seas, sparing no group of animals—from delicate corals to massive whales."[118]
>
> "Some would argue that bycatch is an acceptable consequence of supplying the world with wild-caught seafood. However, too often the scale of mortality is so high that it threatens the very survival of species and their environments. Every year, at least 7.3 million tons of marine life are caught incidentally. In some fisheries, the percentage of bycatch far outweighs the amount of target catch. For example, for every shrimp caught by nets dragged behind trawls in the Gulf of Mexico, over four times its weight is bycatch."[119]

D. The Assault on Sharks

Approximate 100 million sharks are killed annually each year, some, for their fins, which are considered a delicacy in Asia and prepared primarily in soups. Sharks are also killed in shark nets, or deliberately by fisherman.

Another important aspect to note is the lack of regulation in wild-caught fishing as it pertains to animal welfare. In many instances, fish and other animals suffocate, and the law does not require stunning or humane treatment. Additionally, fisherman and other workers in these industries are exploited, and are put in dangerous and problematic situations.

Additional Resources on this subject can be found in our "Resources" section below. Furthermore, this topic was dealt with in our 2020 Resource Packet.

[117] *NRDC:* https://www.nrdc.org/onearth/single-discarded-fishing-net-can-keep-killing-centuries
[118] *ByCatch* https://www.bycatch.org/about-bycatch
[119] *Id.*

10. Selected Impacts of COVID-19 on Aquatic Animals

A. Introduction

While the implications of COVID-19 are yet to be fully determined, and arguably, may never fully be quantified - it is clear that they have been, and will continue to be, extensive. The vast majority of the Earth's population had to shift to a new way of life with more restrictions, lockdowns, and closure of businesses and institutions – to name but a few. Aside from the dramatic impacts on humans - nonhuman animals from around the world have also been affected - from the ones we are spending more time with in our homes, to those in various captive facilities, to those utilized in animal agriculture. Highlighted examples of some of these impacts have been included in this section below.

B. Positive Impacts: Selected Examples

There have been some positive impacts on aquatic wild animals due to less human activities in the ocean (such as shipping, fishing, extractive practices) as well as those on land. Certain animals have been seen further out of their natural spaces - one example is the penguins who have been seen strolling through the streets of Cape Town in South Africa. Fewer people on beaches have allowed for other species, such as leatherback turtles, to increase their presence - scientists have recently the largest number of nests found there in the past two decades in Thailand. Even whales are experiencing quieter oceans due to the reduction in ship traffic in the ocean. While there were certain fake news stories circulated about animals reclaiming Earth - there are numerous other articles of animals returning to waterways and other areas - where they haven't been seen in years.

For those aquatic animals utilized as food, with the closure of restaurants and other factors there were certain places that experienced a decrease in the demand for seafood, which may have temporarily allowed for those fish and other animals, a chance to rebound. In other cases, it resulted in the waste of animals who had already been bred, harvested, or caught.

The coronavirus has helped shine a spotlight on the global trade in wild animals - whether these be terrestrial or aquatic. More specifically, a number of new outlets are now reporting on humanity's use and consumption of wild animals and all animals, whether for food, medicine, or other uses. It has also helped educate people about zoonotic diseases and the interconnectedness of our treatment and use of nonhuman animals.

C. Negative Impacts: Selected

For those who rely on these practices as a means of making a living however, the impacts were not as positive. In the context of wild caught fishing, this plummeting demand, according to the Japan Times, is "likely to create an effect similar to the halt of commercial fishing during both world wars, when the idling of fleets led to the rebound of fish stocks."

Globally, millions of people who rely on the "blue economy" have been devastatingly impacted. Further negative impacts according to the Center for Strategic and International Studies include:

- "Decreased law enforcement at sea may give malefactors more opportunities to fish illegally and to ignore quotas
- Supply chains may face pressure to move toward increased transshipment of fish at sea as ports are closed and access restricted. Such practices are harder to regulate and more likely to be associated with illicit fishing and human rights violations.
- A reduction in operational ocean science (research cruises are already being canceled) could undermine stock assessments and management regimes even in currently sustainable fisheries."

On the aquaculture front (i.e. the farming of aquatic animals), certain reports indicated negative economic impacts for those involved in the industry - such as the loss of jobs, the need for loan and bailouts and others - from all around the globe and highlighted the way that different countries have been dealing with this.

Facilities where animals are kept in confinement and where business is solely dependent on visitors have also been negatively impacted by COVID-19. One of the many restrictions enacted almost uniformly, while to different extents, was the restrictions relating to group gatherings and visiting facilities such as aquariums/seaquariums and zoos. Accordingly, this has led to the closure of some of these institutions, and some are on the edge of losing their business and have lost revenue and are no longer taking care of the animals.

Economic impacts such as the loss of income is not the only factor however. Because COVID-19 is a zoonotic disease, both animals and humans, including workers at these facilities are potentially at risk of contracting and/or transmitting the disease. Sea otters, in particular, are susceptible to the coronavirus, thus additional protocols are required for protection - including requiring staff wear a mask and gloves and maintaining "a good distance from the social mammals."

A number of captive aquatic animals have been infected with the coronavirus – one captive beluga whale infected with a coronavirus showed signs of severe liver damage. Another captive beluga died and the coronavirus was implicated in the cause of death. Three captive bottlenose dolphins had coronaviruses. These are just a few of potentially many examples from around the world. Notably, as with certain people who have the virus being asymptomatic, animals such as dolphins may be infected with coronaviruses but can appear to be in good health.

Other animals impacted by the disease include those used for biomedical and scientific research. Certain laboratories testing the coronavirus vaccine use a component in the blood of horseshoe crabs. For more information see the Section of this Research Packet entitled: "Use of Aquatic Animals in Scientific and Biomedical Research and Medicine".

Sharks, are another unfortunate potential victim in this area. Some conservations groups warn that the coronavirus vaccine could kill half a million sharks due to the compound that is derived from sharks' livers that could be used in vaccine development and production. All of these obviously have a devastating impact on the animals themselves, but more broadly, on their ecosystems as well.

Prior to the COVID-19 pandemic, approximately 8 million metric tons of plastic waste entered the oceans annually, affecting aquatic animals and their habitats. COVID-19 has worsened the ocean plastic pollution problem. Estimates are that due to the pandemic, the 129 billion face masks and 65 billion gloves are used globally every month. Because some of these end up in bodies of water, "The practical problems with gloves and masks finding their way into our rivers and oceans is that they can easily be mistaken for jellyfish, a favorite food of sea turtles. Because of their elastic components, masks also have increased risks of entanglement for a wide variety of fish, animals and birds."[120]

Moreover, it appears that the indirect economic impacts of the pandemic have had a knock on effects on consumer's abilities to purchase more eco-friendly goods. According to a study published in June 2020, "With the economic crisis making the average consumer more price-sensitive, affordable goods are taking precedence over environmentally friendly ones. Since grocery items that come in plastic are universally less expensive, those items are the go-to for cash-strapped shoppers. And while takeout has been the saving grace for many restaurants, it's also contributing to

[120] https://www.scientificamerican.com/article/covid-19-has-worsened-the-ocean-plastic-pollution-problem/, and https://www.theguardian.com/environment/2020/jun/08/more-masks-than-jellyfish-coronavirus-waste-ends-up-in-ocean.

the growing heap of single-use plastic globally. Much of this kind of plastic is not recyclable. 2020 is on pace to see 30% more waste than 2019."[121]

Due to proposed relief bills, acts and efforts, certain industries have been able to apply for funding to ease some of the economic efforts caused by the pandemic. While much uncertainty still remains as to the vastness of the pandemic's effects, it has inevitably impacted on our aquatic earthlings dramatically.

D. Conclusion

While it is almost impossible to say at this point all of the impacts and whether they will be positive or negative, the COVID-19 pandemic has had a major and lasting impact on aquatic animals.

Additional Resources on this subject can be found in our "Resources" section below.

11. Exclusions

A few of the major issues and impacts that we have not addressed for purposes of this Resource Packet, which are critical are (non-exhaustive):

A. Ship Strikes

B. The building of dams

C. Other human structures (including power suppliers)

D. Habitat loss

E. Invasive species

F. IUU fishing

(Illegal, Unreported and Unregulated Fishing)

G. Incidental killing

H. Intentional killing to reduce competition

I. Poaching (illegal fishing)

J. Plastic pollution from lost nets and pens

K. Loss of food for wild fish

L. Specialized hunting activities

… and others!

We hope, however, that is apparent that our impact on aquatic animals and their habitats is vast and far reaching. These continue to increase, and will have devasting impacts, unless we take urgent action.

[121] https://pubs.acs.org/doi/pdf/10.1021/acs.est.0c02178.

12. Aquatic Animals: A Global Perspective

A. Introduction: International Aquatic Animal Law

Why does international law matter for aquatic animals? Because these creatures are utilized in a myriad of ways including: food; entertainment; the pet trade; cultural traditions; research and other contexts. These animals migrate themselves in the wild across different jurisdictions, and are also traded by humans across borders. Aquatic animals are a good example of an "international issue," particularly the ones that live in our oceans and seas. Some examples of key issues for aquatic animals in international law include:

i. Wildlife and Conservation
ii. Aquatic Animals as a Food Source
iii. International Trade
iv. Climate Change

B. International Treaties that may apply to wild-caught aquatic animals

Every year between 1 and 3 trillion fish are intentionally caught from the wild and killed globally.[122] This number does not include farmed fish or fish caught for recreational purposes or fished unintentionally or illegally killed.[123] The market for human consumption of fish is expanding, and fish products account for approximately 39% of animal products consumed globally.[124] Fish migrate through international waters as well as the territorial waters of scores of nations, making it impossible to regulate fisheries without cooperation among nations.

Below some selected international treaties that may apply to fishing are included:

i. Agreement to Promote Compliance with International Conservation and Management Measures by Fishing Vessels on The High Seas

Recognizing that fisheries, including aquaculture, provide a vital source of food, employment, recreation, trade and economic wellbeing for people throughout the world, this agreement sets out principles and international standards of behavior for responsible practices with a view to ensuring the effective conservation, management, and development of living aquatic resources, with due respect for the ecosystem and biodiversity. The objective of this agreement is to strengthen international cooperation with a view to ensuring compliance by fishing vessels on the high seas. It applies to all fishing vessels used or intended for fishing on the high seas. Parties agree to take all necessary measures to ensure that fishing vessels entitled to fly their flag do not engage in activity that undermines the effectiveness of international conservation and management measures and adopt enforcement measures in respect of fishing vessels which act in contravention. Since this agreement applies to fishing generally, it also applies to aquaculture.[125]

ii. The Convention for the Conservation of Anadromous Stocks in the North Pacific Ocean[126]

The Convention works to coordinate efforts and establish an effective mechanism of international cooperation for the conservation of anadromous fish stocks in the North Pacific Ocean. To do so, the treaty establishes the North Pacific Anadromous Fish Commission and defines "fishing" to mean: a) The catching, taking, harvesting of fish, or any other activity which can reasonably be expected to result in the catching, taking and harvesting of fish; b) Any operation at sea in preparation for or in direct support of any activity described in the preceding paragraph (a).

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[122] David N. Cassuto; Amy M. O'Brien, *You Don't Need Lungs to Suffer: Fish Suffering in the Age of Climate Change with a Call for Regulatory Reform,* 5 CAN. J. COMP. & CONTEMP. L 31 (2019).
[123] *Id.*
[124] *Id.*
[125] *Agreement to Promote Compliance with International Conservation and Management Measures by Fishing Vessels on the High Seas*, IUCN (Nov. 29, 1993), *available at*: https://www.ecolex.org/details/treaty/agreement-to-promote-compliance-with-international-conservation-and-management-measures-by-fishing-vessels-on-the-high-seas-tre-001183/.
[126] Convention for the Conservation of Anadromous Stocks in the North Pacific Ocean, Feb. 11, 1992.

iii. The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)[127]

CITES is an international agreement with the aim to ensure that international trade in specimens of wild animals and plants does not threaten their survival. Under CITES there are three different Appendices that determine the restrictions on import, export, re-export, and introduction from the sea. Trade restrictions and regulations depend on whether a species is listed under Appendix I, Appendix II, or Appendix III. Aquaculture issues arise under CITES when Parties harvest and trade commercially exploited aquatic species listed in the CITES Appendices.

iv. Convention on Biological Diversity 1992 (CBD)[128]

The Convention is dedicated to promoting sustainable development recognizing that biological diversity is important not only for plants, animals, micro-organisms and their ecosystems, but also for people globally as it contribute to food security. Aquaculture is particularly dependent on biodiversity for productivity and food security. CBD Parties have been encouraged to create enabling conditions, provide positive incentives and remove perverse incentives for the adoption of sustainable production practices that will benefit biodiversity. CBD also contains several provisions specific to aquaculture particularly concerning the transboundary movement of aquatic organisms and the control of alien species.

v. Others

1. U.N. Convention Law of the Sea (UNCLOS)[129]
2. Ramsar Convention[130]
3. International Convention for the Regulation of Whaling (ICRW),1946[131]
4. Geneva Conventions on the Law of the Sea, 1958[132]
5. Law of the Sea Convention,1982[133]
6. The UN Fish Stocks Agreement, 1995[134]
7. FAO Code of Conduct for Responsible Fisheries, 1995[135]
8. Reykjavik Declaration on Responsible Fisheries in the Marine Ecosystem, 2001[136]
9. Agreement on Port State Measures to Prevent, Deter and Eliminate Illegal, Unreported and Unregulated Fishing, 2009[137]
10. Regional Treaty and Organization Examples
    i. the North Atlantic Salmon Treaty[138]
    ii. the Northwest Atlantic Fisheries Treaty, and the Pacific Salmon Treaty.[139]

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[127] Convention on International Trade in Endangered Species of Wild Fauna and Flora, Mar. 3, 1973, 993 UNTS 243, *available at*: https://www.cites.org/eng/cop/index.php.
[128] Convention on Biological Diversity, Dec. 29, 1993, 1760 U.N.T.S. 79.
[129] United Nations Convention on the Law of the Sea, Dec. 10, 1982, https://www.un.org/depts/los/convention_agreements/convention_overview_convention.htm.
[130] The Ramsar Convention on Wetlands, https://www.environment.gov.au/water/wetlands/ramsar.
[131] International Whaling Commission, https://iwc.int/home.
[132] UNCLOS, *supra* note 126.
[133] *Id.*
[134] *The United Nations Agreement for the Implementation of the Provision of the United Nations Convention on the Law of the Sea of 10 December 1982 relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks*, OCEANS & LAW OF THE SEA (last updated January 11, 2019), https://www.un.org/Depts/los/convention_agreements/convention_overview_fish_stocks.htm.
[135] *Code of Conduct for Responsible Fisheries*, FAO, http://www.fao.org/fishery/code/en.
[136] *The Reykjavik Declaration on Responsible Fisheries in the Marine Ecosystem*, FAO, http://www.fao.org/fishery/docs/DOCUMENT/reykjavik/y2198t00_dec.pdf.
[137] *Agreement on Port State Measures (PSMA)*, FAO, http://www.fao.org/port-state-measures/en/.
[138] *North Atlantic Salmon Treaty*, NORTH ATLANTIC SALMON CONSERVATION ORGANIZATION, http://www.nasco.int/convention.html.
[139] *Digest of Federal Resource Laws of Interest to the U.S. Fish and Wildlife Service*, FWS, https://www.fws.gov/laws/lawsdigest/treaty.html#PACIFIC.

iii. Regional Fisheries Management Organizations (RFMOs) will not be discussed here but should be noted.[140]

C. International Instruments that may apply to Aquaculture

i. Introduction

The market for human consumption of fish is expanding, and fish products account for approximately 39% of animal products consumed globally.[141] Farmed fish account for 70% of all animals farmed worldwide and the fish farming industry has been expanding at a rate of 8% per year since the 1980s.[142] While there are currently no international agreements that apply to aquaculture, there are some that could potentially apply to aquaculture. Listed below are some international treaties that the U.S. is a party to that could apply to aquaculture. Other relevant treaties include, the Convention on International Trade in Endangered Species, Agreement to Promote Compliance with International Conservation and Management Measures by Fishing Vessels on The High Seas, and the Convention for the Conservation of Anadromous Stocks in the North Pacific Ocean, which are discussed above in the wild-caught fish section.[143]

ii. Codex Alimentarius, 1963[144]

The Codex Alimentarius is a collection of food safety standards, codes of practice, guidelines and other recommendations developed under the guidance of the Codex Alimentarius Commission (CAC) to protect consumers' health, ensure fair-trade practices in the food trade and promote coordination of all food standards' work undertaken by IGOs and NGOs. The CAC is the central part of the Joint FAO/WHO Food Standards Program. There are presently around 200 Codex Standards, of which several are applicable to fisheries commodities. There are currently 18 standards, two guidelines, and the Code of Practice for Fish and Fisheries Products, which also covers the aquaculture sector.

iii. Convention on the Inter-American Institute for Cooperation on Agriculture, 1979[145]

This Convention establishes the Inter-American Institute for Cooperation on Agriculture whose purpose is to encourage, promote, and support the efforts of the Member States to achieve their agricultural development and rural welfare.

The objective is to improve the productivity and competitiveness of the agricultural sector, strengthen agriculture's contribution to the development of rural areas and the well-being of the rural population, improve agriculture's capacity to mitigate and adapt to climate change and make better use of natural resources, and improve agriculture's contribution to food security.

iv. World Organization for Animal Health ("OIE") [146]

The World Organization for Animal Health, also known as OIE, is an international organization with the mission to provide a better guarantee of safety of food of animal origin and to promote animal welfare through a science-based approach, among other things. While the OIE's main focus is on animal health and diseases in order to safeguard humans, it is also involved in the development of work relating to animal welfare.

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[140] *Regional fisheries management organizations and deep-sea fisheries,* FAO, http://www.fao.org/fishery/topic/166304/en.
[141] David N. Cassuto, *supra* note 119.
[142] *Id.*
[143] FAO, *supra* note 114.
[144] *About Codex Alimentarius,* CODEX ALIMENTARIUS, http://www.fao.org/fao-who-codexalimentarius/about-codex/en/#c453333.
[145] Convention on the Inter-American Institute for Cooperation on Agriculture of 1979, art. 4, Mar. 6, 1979.
[146] *Aquatic Animal Health Code*, OIE, https://www.oie.int/standard-setting/aquatic-code/.

The OIE Aquatic Animal Health Code (the Aquatic Code)[147] provides standards for the improvement of aquatic animal health worldwide. This includes standards for the welfare of farmed fish. The Aquatic Code provides sanitary measures for the import and export of aquatic animals to prevent the spread of disease via international trade in the aquatic animals and their products. OIE also publishes a Manual of Diagnostic Tests for Aquatic Animals (Aquatic Manual) which provides effective laboratory testing for pathogenic agents that may adversely affect aquatic animals to support the Aquatic Animal health Services.

13. Resources (Selected and Non-Exhaustive)

There are a number of useful resources to find out more about aquatic animals. These range from scientific evidence about their capacities and abilities, to the law that applies to them.

Below is a non-exhaustive list of resources where one can look to find out more about these fascinating creatures. Some other resources can be found throughout the Resource Packet, in Resource Sections and in the footnotes.

A. Resources from or by the staff of the Aquatic Animal Law Initiative

i. Kathy Hessler and Amy P. Wilson: Swimming Against the Current: Advocating for Aquatic Animals
ii. Kathy Hessler and Amy P. Wilson: Tipping the Scales: How Law and Policy Fail Aquatic Animals
iii. Kathy Hessler and Amy P. Wilson: Making Waves: Changing the Status Quo for Aquatic Animals
iv. Kathy Hessler: The Rise of Aquatic Animal Law: Webinar
v. World Aquatic Animal Day 2020 Resource Packet
vi. Kathy Hessler: Aquatic Animals: The Need for Understanding and Legal Protection (ABA TIPS Committee) Spring 2020

B. Resources on Aquatic Companion Animals

Fish:

i. Fish Welfare and Coral Reef Protection: https://forthefishes.org/
ii. Fishing for answers: improving welfare for aquarium fish, https://www.inboxdollars.com/search/infospace?category=web&query=Fishing%20for%20answers%3A%20improving%20welfare%20for%20aquarium%20fish

[147] The Aquatic Code and Aquatic Manual can be found at the following links: https://www.oie.int/en/standard-setting/aquatic-code/access-online/ and https://www.oie.int/en/standard-setting/aquatic-manual/access-online/.

iii. The Ornamental Fish Trade: An Introduction with Perspectives for Responsible Aquarium Fish Ownership, https://edis.ifas.ufl.edu/fa124

Reptiles and Amphibians

i. From Ocean to Aquarium: the global trade in marine ornamental species, https://www.unep-wcmc.org/resources-and-data/from-ocean-to-aquarium--the-global-trade-in-marine-ornamental-species
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iii. Scales and tails: The welfare and trade of reptiles kept as pets in Canada, https://www.zoocheck.com/wp-content/uploads/2016/06/Reptile_Report_FA.pdf
iv. Various Reptile, Amphibian And Fish Issues: https://www.zoocheck.com/feature-campaigns-2015/exotic-pets/reptile-and-amphibian-issues/

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iv. Dolphin and Human Interactions, Detailed Discussion of Legal Implications of Dolphin and Human Interactions, https://www.animallaw.info/article/detailed-discussion-legal-implications-dolphin-and-human-interactions
v. Swimming with Dolphins, WDC, https://us.whales.org/swimming-with-dolphins/

Recreational Fishing and "Catch and Release"

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Fish Pain

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Catch and release

ix. Catch and release fishing, https://www.nps.gov/subjects/fishing/catch-and-release-fishing.htm
x. What's So Humane About Catch and Release Fishing?, http://nurturenaturenow.com/whats-so-humane-about-catch-and-release-fishing/
xi. The Cruelty of Catch-and-Release Fishing, https://www.peta.org/living/entertainment/the-cruelty-of-catch-and-release-fishing/
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D. Resources on Aquatic Animals used in Science and Medicine

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E. Resources on COVID-19 and Aquatic Animals

i. Silence is golden for whales as lockdown reduces ocean noise
Rays, sharks, and dolphins enjoy new freedom as humans retreat from the oceans
Coronavirus: Wild animals enjoy freedom of a quieter world
Pandemic impact spreads to North American aquaculture
At Monterey Bay Aquarium, the sea animals are doing great, but business is tanking
ii. How captive animals are coping with the sudden emptiness of the world's zoos and aquariums
iii. Covid-19 at Sea: Impacts on the Blue Economy, Ocean Health, and Ocean Security
iv. COVID-19 Has Worsened the Ocean Plastic Pollution Problem
v. World Oceans Day – UK aquariums facing challenge to survive COVID-19 lockdown
vi. COVID-19 lockdown: animal life, ecosystem and atmospheric environment

F. Animal Law Resources

i. Kathy Hessler, Rebecca Jenkins and Kelly Levenda: Cruelty to Human and Nonhuman Animals in the Wild-Caught Fishing Industry
ii. Kelly Levenda: Legislation to Protect the Welfare of Fish
iii. Corrigan Z. (2017) Water and Marine Animal Law. In: Steier G., Patel K. (eds) International Farm Animal, Wildlife and Food Safety Law. Springer, Cham
iv. Let Fish Live: Legal Treatment of Fishes
v. NOAA Fisheries Website: Laws and Policies
vi. Webinar: Aquatic Animal Law: Overview, Aquaculture, and Alternatives 2019

vii. Webinar: Captive Aquatic Animals in Public Aquariums 2019

G. Websites

i. Food & Agriculture Organization of the United Nations: The State of World Fisheries and Aquaculture 2020 (Browse the Interactive Story)
ii. Center for American Progress: American Aquaculture An Overview of the Current Status, Environmental Impacts, and Legislative Opportunities
iii. Friends of the Earth: The Dangers of Industrial Fish Farming
iv. Center for Food Safety: Case Summary and Papers
v. Dr. Martin Cooke - Animal Welfare in Farmed Fish
vi. Center for Food Safety: Various Tabs (Browse Website)
vii. World Aquatic Animal Day Website
viii. Aquatic Animal Law Initiative Website
ix. 50 by 40: Home
x. 30 by 30: Home
xi. Global Deal for Nature
xii. The Life of A Farmed Fish

H. Scientific Resources (Selected)

i. Culum Brown, Fish intelligence, sentience and ethics.
ii. Donald Broom, Cognitive ability and sentience: Which aquatic animals should be protected?
iii. Mark Bekoff, Aquatic Animals, Cognitive Ethology, and Ethics: Questions About Sentience and Other Troubling Issues that Lurk in Turbid Water.
iv. Jonathon Balcombe, What a fish knows
v. Jonathan Balcombe, Cognitive evidence of Fish Sentience
vi. Culum Brown: How fish think and feel, and why we should care about their welfare
vii. Victoria Braithwaite, Do fish feel pain?
viii. Lynne U. Sneddon, Pain in Aquatic Animals
ix. Lynne U. Seddon, Pain perception in fish: indicators and endpoints
x. Professor John Webster, Fish are sentient beings
xi. Isabelle Maccio-Hage, Pain in fish
xii. Johnathan Balcombe, Cognitive evidence of Fish Sentience
xiii. Victoria A. Braithwaite: Why human pain can't tell us why fish feel pain
xiv. Donald M. Broom: Fish brains and behaviour indicate capacity for feeling pain
xv. Culum Brown: Comparative evolutionary approach to pain perception in fishes
xvi. Pentii O. Haikonen: On the sentience of fish
xvii. Robert C Jones: Fish sentience and the precautionary principle
xviii. Yew-Kwang Ng: Could fish feel pain? A wider perspective
xix. Anil K Seth: Why fish pain cannot and should not be ruled out
xx. Lynne U. Seddon and Mathew C. Leach: Anthropomorphic denial of fish pain
xxi. V.A Braithwaite, P. Boulcott: Pain Perception, Aversion and Fear in Fish
xxii. Numerous *authors:* Adult Cleaner Wrasse Outperform Capuchin Monkeys, Chimpanzees and Orangutans in a Complex Foraging Task Derived from Cleaner - Client Reef Fish Cooperation
xxiii. Carl Safina: Fish pain - a painful topic
xxiv. Silji Kittilsen: Functional Aspects of Emotions in Fish
xxv. *Numerous authors:* Behavioural Indicators of Welfare in Farmed Fish
xxvi. *Numerous authors:* Variation in Emotion and Cognition Among Fishes
xxvii. *Numerous authors:* Fish can show emotional fever: Stress-induced hyperthermia in zebrafish
xxviii. Kelly Levenda, Sensitizing humans to fish sentience. Commentary on Balcombe on Fish Knows

I. Documentaries

i. Seaspiracy
ii. My Octopus Teacher
iii. Mission Blue
iv. Dark Hobby
v. Sonic Sea

vi. Damnation
vii. Blackfish
viii. The Cove
ix. Chasing Coral
x. A Plastic Ocean
xi. Artifishal
xii. Lolita – A Slave to Entertainment
xiii. The Last Ocean
xiv. Plastic Paradise
xv. The End of the Line

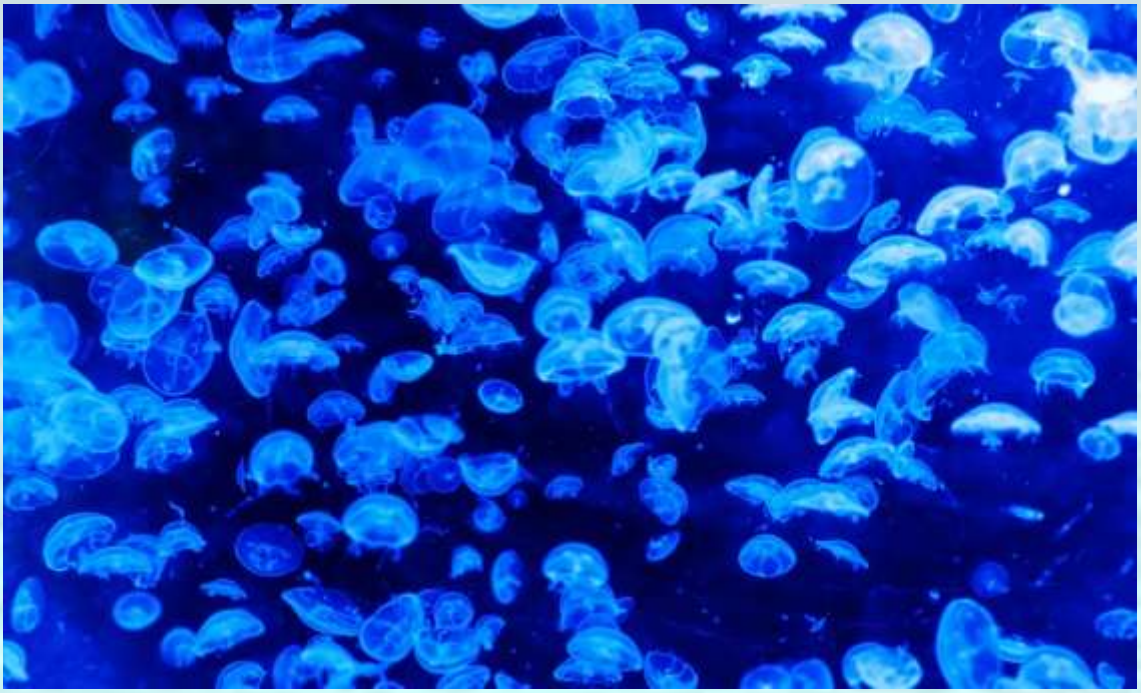
J. Additional Articles

i. Financial Times: Plant-based fish is the new plant-based meat
ii. Kristin Hettermann: Fish as food or fish as wildlife
iii. Civil Eats by Lisa Held: The continued fight over farming in the oceans
iv. Seafood Source by Christine Blank: Plant-based, cellular aquaculture invasion into seafood likely to arrive in 2021

K. Organizations

There are so many wonderful organizations around the work working on aquatic animal issues, as well as protection of their habitat and the environment more broadly. Some of these organizations focus on specific species; issues and threats; geographic locations; or other matters; while some organizations work on animal protection and have specific projects relating to aquatic animals.

We encourage you to research the various organizations; and if you have a specific interest; connect with an organization and offer to assist or see how you may get involved and support their work!



14. Looking ahead – Aquatic Animal Law

The field of aquatic animal law in very new and will continue to grow. In 2019, the first Aquatic Animal Law course was taught by Professor Kathy Hessler at the Center for Animal Law Studies at Lewis & Clark Law School. It continued in 2020, and will be taught again in June 2021. This course is completely online and available to students around the world.

It will present an overview of the laws and regulations affecting aquatic animals as well as analysis of areas needing regulation. The course will consider U.S. federal law (including the Marine Mammal Protection Act, Animal Welfare Act, Endangered Species Act) as well as state anti-cruelty laws and some local ordinances (including those related to zoning, breeding, transportation, and display).

It will also include examination of the scientific underpinnings of legal decision-making with regard to aquatic species. The course will look at the application of law, or lack thereof, in contexts including: agriculture, research, entertainment, and companion animals. The course will also briefly review some international laws and treaties. See more here.

We are pleased to note that we are working on the first of its kind "Aquatic Animal Law" textbook with Carolina Academic Press due for release in 2022. The authors are: Professor Kathy Hessler, Kelly Levenda, Rebecca Jenkins, Amy P. Wilson and Sonia Waisman.

15. Acknowledgements

Thank you for reading our Resource Packet, we hope you found it useful and educational. We would like to acknowledge those who made it possible.

This document has been prepared by members and volunteers of the Animal Law Clinic.
Class of 2021: Caitlin Skurky and Patty Keough; Extern: Mary Hoffman; Volunteers: Miranda Groh; Lyudmila Shegay; and Jackson Moffett.

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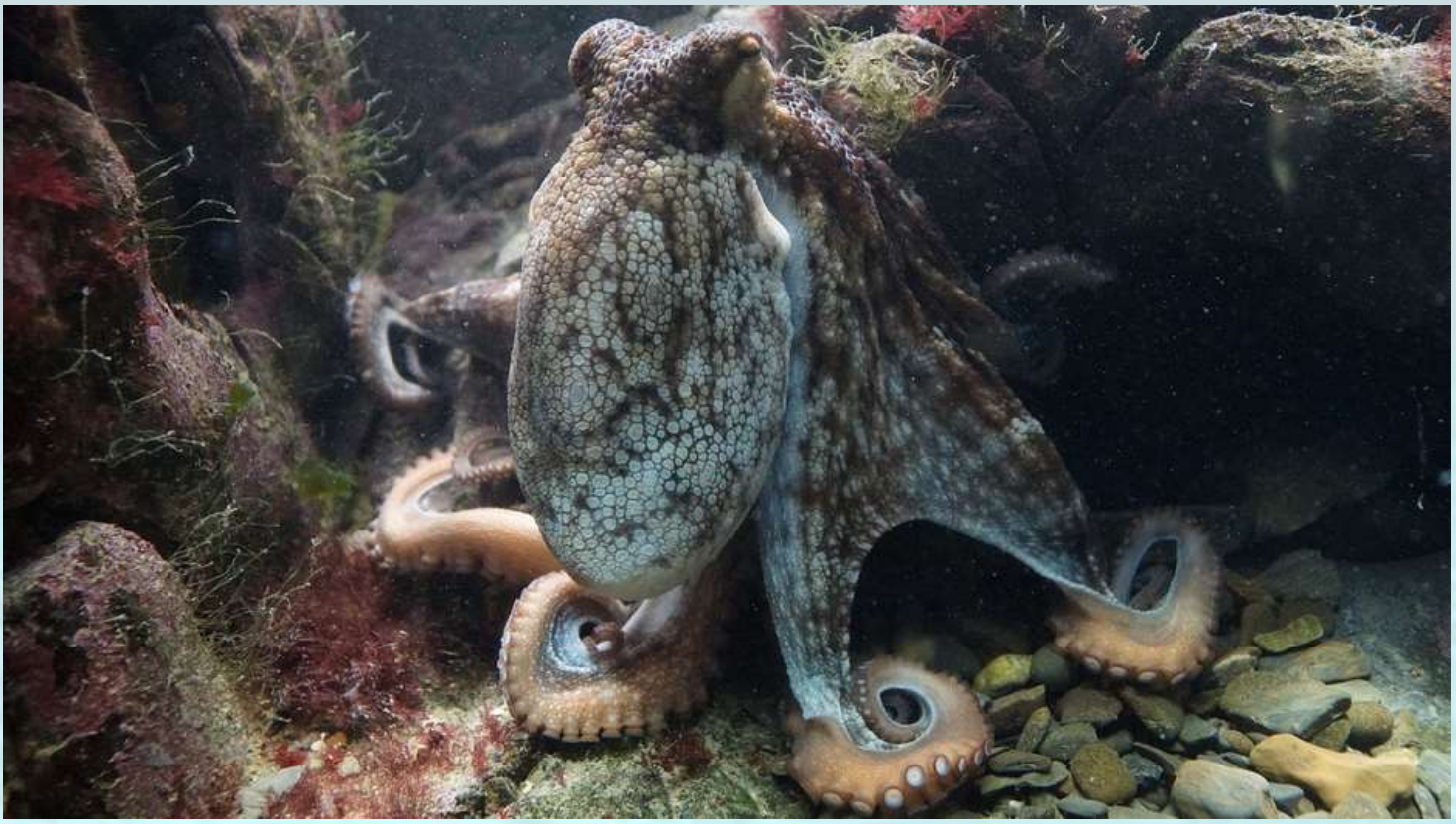
For more information, about us and the work we do, please check our Website.



“Sea” you again next year for World Aquatic Animal Day 2022!