

Marine Capture Fisheries: Best Practices for Aquatic Animal Welfare

Third Edition

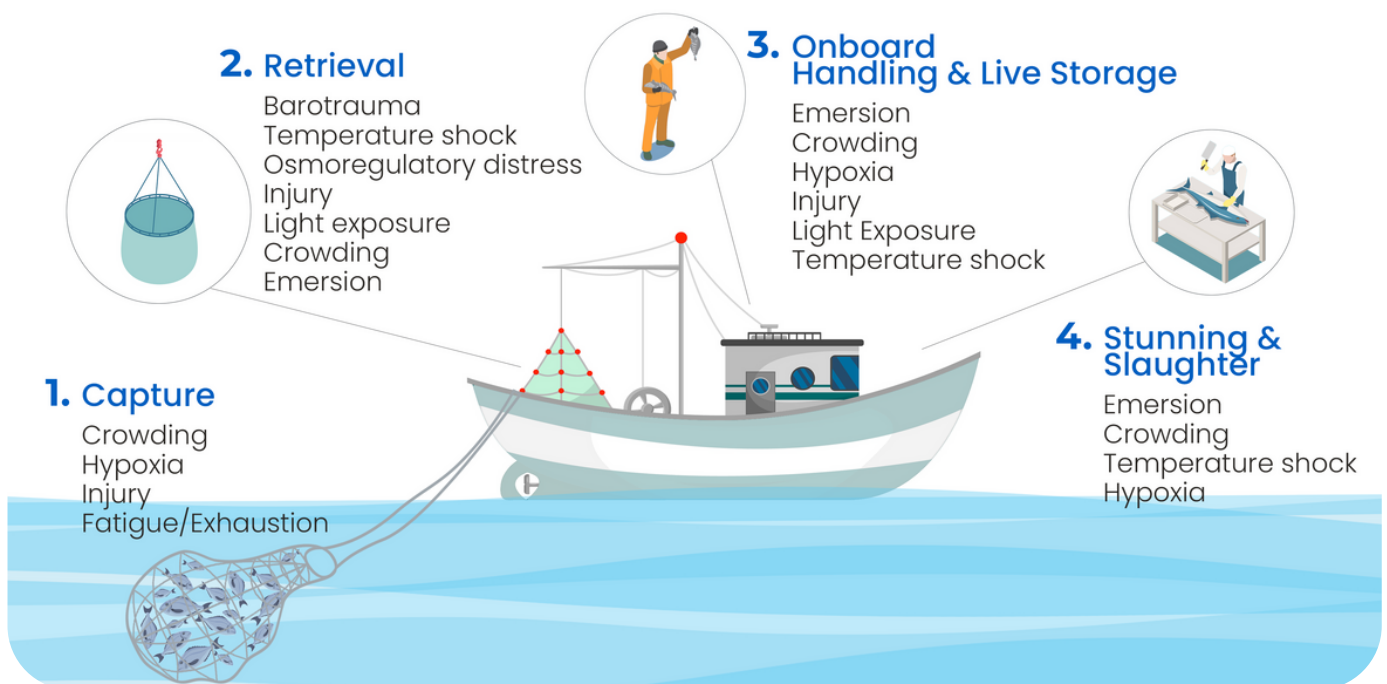


AQUATIC LIFE
—INSTITUTE—

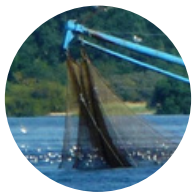
MARCH 2024

Introducing the third edition of our Best Practices Report, where we seek out the latest advancements in fishing vessels, companies, and research institutes engaged in groundbreaking efforts to enhance animal welfare in capture fisheries. While technologies exist, their integration into fisheries carries additional complexities that have yet to be solved, such as large volumes of mixed-species and rough sea conditions. Despite these challenges, commendable efforts are being made to steer towards more humane capture fisheries. We strongly advocate for the widespread adoption of these progressive practices, coupled with the implementation of regulatory policies to safeguard the welfare of aquatic animals.

Animal Welfare Risks in Capture Fisheries



Adapted from Davis (2002), Broadhurst et al. (2006), Breen and Catchpole (2020)



1. Capture

More humane catch and retrieval methods are key to improved animal welfare *and* better product quality. By limiting catch volumes through shorter fishing duration and smaller nets, target animals are exposed to less stress during capture and have a greater chance of survival. This reduced stress also leads to lower levels of lactic acid in the body, resulting in better flesh quality and longer shelf life.

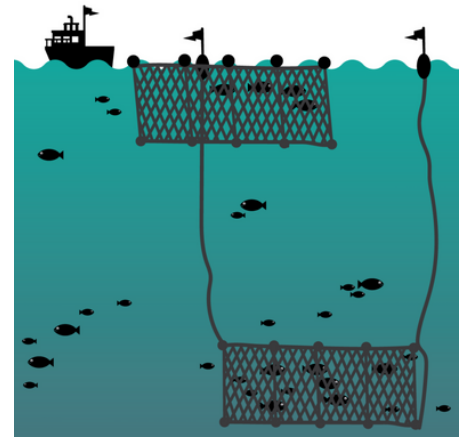
Best practice examples:

Company / Fishing Vessel (FV)	Gear / Species	Technique	Photo	Benefits
Bristol Bay Native Corporation / FV Blue North	Longline Pacific cod	<ul style="list-style-type: none"> Fish are individually hooked and retrieved. Uses a 'Moon Pool' to set lines and haul catch one by one inside the vessel. Working to improve a prototype of an onboard electrical stunning machine. 		<ul style="list-style-type: none"> Shorter fishing time reduces stress and injury to target species. Reduced likelihood of catching non-target species. 'Moon Pool' improves crew safety through minimizing exposure to the elements. Stunning + once frozen fillet commands a higher price per pound than traditional non-humane harvest, once or twice frozen fillet.
Nofima	Purse seine Various species	Nofima recommends using knotless netting, keeping hauling time as short as possible, and not exceeding 5-7 tons in catch volume. The entire Norwegian purse seine fleet in fact limits catch duration to about 1 hour and pumps the catch onboard.		<ul style="list-style-type: none"> Reducing catch volume helps reduce injury and stress during capture. Crowding is a major cause of fish mortality in net, fillet quality reduction, and mortality of released fish. Knotless netting increases the chance of survival of escaped fish. Reducing catch duration and pumping fish onboard significantly reduces stress in animals.
Norwegian Institute of Marine Research	Purse seine Pelagic species (e.g. mackerel, tuna, etc.)	Developed a 'Catch Monitoring Probe' which gives fishers insight on the crowding density of fish inside their nets, oxygen availability, temperature and depth via 360° cameras, an oxygen and depth meter, and other instruments.		<ul style="list-style-type: none"> Allows fishers to monitor fish welfare and quality early in the capture process when it is still legal to release fish. Provides a simplified and cost-effective method to accurately identify species, fish size and behavior of the catch underwater inside the purse seine net. Currently being tested on 4 commercial fishing vessels.
North Star Fishing Co. / FV North Star	Demersal trawl Bearing Sea cod, flatfish, rockfish	Trawl gear has been modified to use sweeps raised off the seafloor to reduce the effect of fishing on the seafloor and its habitat.		<ul style="list-style-type: none"> Research by NMFS scientists has shown that the use of elevated sweeps dramatically reduces the effects of fishing on seafloor habitats and the associated species, such as crab and structure-forming animals called epifauna.
Institute of Marine Research, the University of Tromsø, and SINTEF Ocean	Demersal trawl	Researchers are testing a new trawl gear called Semi-Circle Spreading Gear (SCSG) and have demonstrated a considerable reduction in bottom impact due to its hydrodynamic design, weight distribution, and insights from previous under vane gearing observations.		<ul style="list-style-type: none"> Significantly less bottom impact than similar rockhopper gear. Weights 1/3 of similar rockhopper gear Reduces occurrence of fish slipping beneath the fishing line by 20% compared to normal rockhopper gear. Fish overrun by the gear can be damaged and could be part of unaccounted mortality inflicted by the fishery.
Spencer Gulf & West Coast Prawn Fisherman's Association Inc.	Demersal otter trawl King Prawns, Slipper Lobster, Southern Calamari	<ul style="list-style-type: none"> 'Hopper system' provides a wet well for animals caught in the codend where water is kept oxygenated. 'Crab bags' inside the codend separate bycatch from target species. Average trawl duration is 30-60 minutes. 		<ul style="list-style-type: none"> Designed to separate bycatch and improve prawn quality. Safe and quick process to return non-target species to the ocean. Short trawl durations reduce mortality, crushing injury, stress and suffocation. It also allows the vessel to move to other locations if bycatch levels are too high.

Case study: Gill Net and Trammel Net Fisheries

Issues: Associated with pain, injuries, depredation, suffocation, exhaustion and stress during tangling, as well as with ghost fishing and high mortality rates of Protected, Endangered and Threatened species. Duration of fishing could last 2-3 days, increasing loss of vitality.

Improvements: Research from Carefish recommends reducing fishing time and modifying the length, hanging ratio, depth, mesh size and tension of the net. Research in Norway shows that limiting soak time to 2 hours results in 95% live fish and 12 days of shelf life, compared to 25% live fish and 8 days of shelf life when left >24 hours.



Source: Carefish.net

Case study: Cod-end Technology for Improved Fish Quality and Survival

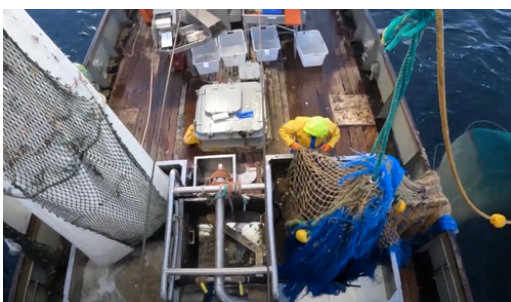
- Precision Seafood Harvesting Co. developed a Modular Harvesting System (MHS) to replace conventional trawl mesh. It is a membrane-like fabric tube with escapement holes that replaces the mesh cod-end of a trawl to reduce fish damage during trawling, haul back and unloading. It allows the fish to swim comfortably, and small & unwanted fish to escape unharmed and free from exhaustion.
- Now, researchers from Wageningen University are testing the effectiveness of attaching the MHS cod-end to a large beam trawl for survival probability of discarded plaice, turbot and sole. They found that:
 - On average the MHS resulted in an 11x increase in survival for plaice and a 6x increase for turbot. No significant effect was detected for sole.
 - Refinement in fishing technique and improved onboard catch processing may further increase survival.
 - Another study on selectivity is in process.



MHS Cod-end

Source: Wageningen Marine Research

MHS vs. Conventional



MHS vs. Conventional



MHS vs. Conventional

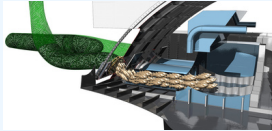



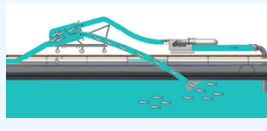




2. Retrieval

The retrieval phase of the capture process, during which aquatic animals are hauled on board, causes significant suffering and injury to aquatic animals. Pumping fish onboard should be used instead of lifting nets onboard.

Best practice examples:

Company	Gear / Species	Technique	Photo	Benefits
Ulstein / FV ECOFIVE	Factory trawler	Retrieves fish via an in-water electrical pump stunner (by Ace Aquatec) so that fish are pumped into the vessel while being stunned. Won the 2022 Innovation Award at Nor-Fishing.		<ul style="list-style-type: none"> Fish never leaves water. Fish is not exposed to the same physical stress as when hauled onto the deck above the trawl slip, improving animal welfare and quality of catch. Pumping fish onboard while stunning provides a humane solution to multiple welfare risks.
CFLOW	Pelagic vessels	Norwegian CFLOW designs fish handling equipment that allows for gentle handling of fish. The objectives are to reduce stress and injury to fish during retrieval and handling, minimize handling time, increase efficiency and profitability.		<ul style="list-style-type: none"> Fish never leaves water. Safe environment for the crew, higher catch quality by bringing in live fish, and enhanced working efficiency. Price depends on volume, number of holding tanks, size of ship, etc, but ranges from smaller fishing vessels at €100,000 to large pelagic trawlers at >€2,000,000.
KER Group	Pelagic vessels	The vacuum pump can be fitted to various pelagic vessel sizes and suit any situation, including single, dual, triple, or quad pumping arrangements.		<ul style="list-style-type: none"> Fish never leaves water. Improves produce quality. Safer handling for crew.
MMC First Process	Pelagic vessels and trawlers	Vacuum pump systems are designed to specific required capacity, available space and type of fish.		<ul style="list-style-type: none"> Pumping reduces loss at sea and during processing. Retains superior product quality. Safer handling for crew.
Melbu Systems	Various	The fish pump is filled with water at all times and can be used with various types of fish and sizes.		<ul style="list-style-type: none"> Fish never leaves water. Pumps fish for gentle retrieval. Safer handling for crew.



3. Onboard Handling

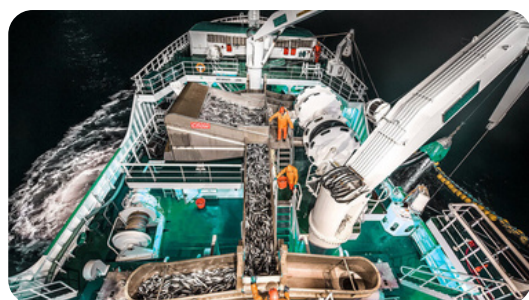
Two key factors during handling affect animal welfare onboard: Time that fish spends out of water and how they are sorted. Currently, the most common practice is to leave the fish suffocating on deck. The time that fish is kept out of the water should be limited as much as possible. This means that fish should be pumped onboard to remove manual handling and be transferred as soon as possible to species-appropriate tanks designed to hold live fish.

Best practice examples:

Live storage: Only undamaged fish should be stored alive, and the storage compartments or tanks must have a flat bottom with a sufficient oxygen supply which is calibrated to the quantities of fish being loaded and stored. As sufficient oxygen levels are particularly vital during loading of live fish, the oxygen levels must be monitored closely and continuously adjusted both when loading and keeping the fish in storage.



Live haddock onboard the fishing vessel's tank.
Source: Nofima



CFlow's onboard storage equipment.
Source: CFlow





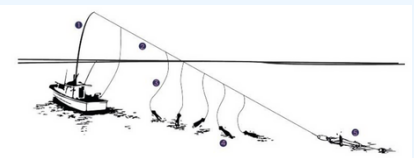

4. Stunning and Slaughter

Stunning technology exists today for the majority of species caught by commercial fishing vessels, and should be mandated by legislation to ensure broad adoption. Key advantages of stunning before slaughter includes not only improved animal welfare, but also better crew safety, higher product quality, and longer shelf life. Stunning techniques include: 1) Electrical stunning (e.g. Dry/semi-dry, in-water) and 2) Mechanical stunning (e.g. percussive, spiking).

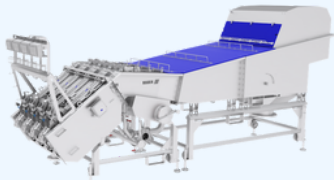
Best practice examples:

Company	Species	Technique	Photo	Benefits
Dry/semi-dry Electrical Stunning				
Mitchell & Cooper	Crustaceans (Lobster, crayfish and crab)	Crustastun is a humane and swift method of stunning crustaceans for individual use. Compared to boiling, which can take up to three minutes to kill even a small lobster, Crustastun renders the animal unconscious within half a second.		<ul style="list-style-type: none"> Crustastun is recognized by the RSPCA as a humane method of stunning crustaceans ready for cooking. Costs 3,686€ per unit.
Norwegian Institute of Marine Research (IMR) & Nofima	Mackerel	Researchers have validated an electrical stunning technique for mackerel (via Optimar stunning machine) that can be used on fishing vessels with a combination of electrical stunning and chilling.		<ul style="list-style-type: none"> Effective at stunning mackerel consistently within 0.5 seconds without negative impacts on product quality.
Optimar	All	Norwegian company Optimar has a dry electrical stunning machine that can be adjusted for all vessels sizes and species. Their semi-dry machine is for shrimps only.		<ul style="list-style-type: none"> Several species have been tested for full unconsciousness using EEG, adhering to EU and Norwegian laws. Additional testing of crustaceans planned. Costs between 43,000€ to 67,000€ depending on size & capacity/hour.
Polar Systems	Crustaceans (Crab)	The electrical stunning unit is designed to apply a suitable current through the body of the crustacean, on an earthed belt using only saline spray and an associated array of independent flexible contactors charged with electricity.		<ul style="list-style-type: none"> The system is simple, compact and economically designed, offering users easy control, cleaning, maintenance and reliable use, without a large number of consumable and wearing parts. Batch systems range from 100kg/hr.
In-water Electrical Stunning				
Ace Aquatec	All	<p>Scottish company Ace Aquatec has an in-water electrical stunner system that can be applied to all vessel sizes and species. It stuns fish fully unconscious in less than one second while keeping the fish in water.</p> <p>Portable and containerized versions of the stunner are available for wild-caught shrimp and prawns.</p>	 	<ul style="list-style-type: none"> Fish remains in water, thereby reducing stress and improving product quality. Academically-proven via EEG tests for unconsciousness (adheres to EU & Norwegian law). Standard in-water stunners cost between 80,000€ and 160,000€ depending on the model.

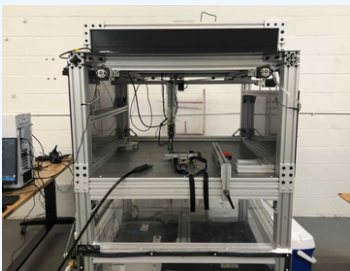
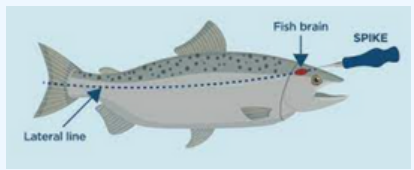
In-water Electrical Stunning

Company	Species	Technique	Photo	Benefits
Askvik Aqua	All	Norwegian company Askvik Aqua has an in-water electrical pump stunner that can be applied to any fishing vessel of any size.		<ul style="list-style-type: none"> Fishes never leave water, thereby reducing stress. Undergoes EEG testing in both test and production facilities by 3rd parties to verify rapid anesthesia according to EU and Norwegian laws. Price ranges from stunners for small-capacity vessels starting at 30,000€ and >100,000€ for high capacity vessels.
Efectos Navales del Atlántico	Large pelagics (e.g. sharks, tunas)	Spanish company Efectos Navales has an in-water electrical stunning machine for large species >30t such as big eye tuna and mako shark on artisanal pole and line fishing vessels. Currently working with researchers to verify if full unconsciousness is achieved.		<ul style="list-style-type: none"> For big eye tuna, stunning reduces stress, thereby reducing accumulation of lactic acid. This produces a more valuable product which can be classified as "sashimi grade." Immobilizing large fish allows for easier and safer retrieval, handling and slaughter by crew. Costs 3,000€ for each machine.
JC Mackintosh	Bluefin tuna	This Spanish company adopted the Green Stick method from Japan to catch tuna. Coupled with an electrical stunner and immediate slaughter via ike jime, they have created a highly selective and humane fishing practice. It is being used on all four of their vessels.	 	<ul style="list-style-type: none"> High selectivity limits catch to target tuna & avoids incidental catch of sharks, dolphins, etc. Eliminates the need for live or frozen bait, avoiding the sacrifice of other fish and added expense. Stunning + ike jime slaughter + bleeding + evisceration + controlled chilling all done on board by hand and immediately after the tuna is caught drastically improves fish quality and cost premium.

Mechanical Stunning: Percussive

Baader	Salmon	German company Baader has a BAADER 101 Harvesting System, using a combination system of percussive stunning and bleeding.		<ul style="list-style-type: none"> Induces immediate insensibility by administering a severe blow to the skull of the fish. As a result, the fish remains unconscious until death. Costs between 400,000€ and 750,000€.
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Mechanical Stunning: Spiking




Shinkei Systems	Finfish	US company Shinkei Systems has developed an automated ike jime (manual spiking) system using computer-vision to process the fish, recognizing different sizes and species.		<ul style="list-style-type: none"> The automated system helps avoid human error and ensures precision spiking every time. Commands a price premium due to better quality, taste and longer shelf life. Machines can be leased annually; discounted pricing plan available for pilot partners.
Various	Various	Ike jime is a traditional Japanese slaughter technique that involves instantaneously euthanizing a fish by inserting a spike into its brain cavity. The fish is then thoroughly bled and undergoes spinal cord destruction before getting iced down.		<ul style="list-style-type: none"> Apart from being a more humane method of slaughter, ike jime produces better flavor of the fillet by avoiding stressing the fish, which leads to lactic acid and cortisol build up in the body. The product stays fresh for longer. Produces sashimi-grade fish for a price premium.

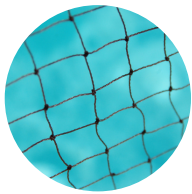


5. Bycatch

Bycatch animals undergo the same suffering and death as target species. Even when released, their chances of survival are minimal. This is a highly wasteful use of aquatic animal resources.

Best practice examples:



Company	Gear / Species	Technique	Photo	Benefits
SafetyNet Technologies	All	The CatchCam camera lets fishers gain a clearer insight into the behavior of the catch both in and around the fishing gear. The Pisces Light works by exploiting the behavioral response of marine species to colored and flashing light. Different colors of light will attract some marine species while scaring away others.		<ul style="list-style-type: none"> Increases gear selectivity. Waterproof up to 800m. Gain insight into fish behavior to help target species more consistently and sustainably. Costs between 5.200 to 14.000 euros for CatchCam and 15.600 euros for Pisces Light.
Deep Vision	Trawlers	Deep Vision is an advanced subsea vision system that identifies and measures fish underwater in real-time. A Deep Vision subsea camera attached to the trawl to identify target and bycatch species before bringing the catch onboard.		<ul style="list-style-type: none"> Monitors catch to only keep target species and releases bycatch and undersized fish. Catch more efficiently (less time, less fuel). Be informed in real-time of type and size of fish entering the trawl. Can be redesigned to tie to other gear besides trawls; maximum depth limit is 1.000 to 2.000 meters. Cost: 75.000 euros.
Flanders Research Institute for Agriculture, Fisheries and Food (ILVO)	Belgian beam trawlers	Researchers in 2023 concluded that reducing catch weights and eliminating catching debris (e.g. stones) should reduce the injury and mortality of discarded EU plaice in >221-kW double-rigged Belgian beam trawlers.		<ul style="list-style-type: none"> Longer stress-exposure times during trawling (i.e. deployment duration) increased the likelihood fish suffered injuries—rather than the abundance and/or type of sediment. The effect of injury-inducing elements may even be more deleterious in heavy seas and could evoke close to 100% mortality.



6. Ghost Gear

Ghost gear refers to abandoned, lost, or discarded fishing gear that continues to drift in the ocean and kill marine life. Ghost gear contributes to overfishing and exacerbates ocean plastics pollution. It is also economically unfavorable to the fishing vessel.

Best practice examples:

Company	Gear / Species	Method	Photo	Benefits
RESQUNIT	Pots and traps	RESQUNIT is a functional and affordable backup buoy system with a programmable electronic release mechanism to locate and retrieve lost recreational and commercial pots and traps.		<ul style="list-style-type: none"> Estimated lifespan is 3 years. Max. depth of 50 meters / 165 feet. Price starts at \$95 USD, with discounts available for bulk orders.
Notus Electronics	All	Notus Electronics is a developer and manufacturer of advanced, wireless net monitoring, gear finding and target detection systems. Their GEARFINDER 700 is designed to quickly and efficiently locate fishing gear.		<ul style="list-style-type: none"> Locates lost gear for any type of fishing gear via geolocation and the only system in the market that can geolocate bottom longline gear and gillnets. Speeds up gear recovery in everyday operations. Supports up to 1.000 distinct sensors. Cost: 11.639€.
PingMe	All	PingMe™ uses an advanced localization, position and identification (unique ID) system for tagging fishing gear/objects and giving the location of the gear under water. It prevents loss of equipment and reduces ghost fishing.		<ul style="list-style-type: none"> The PingMe system helps prevent gear loss, saves time searching for lost gear, and streamlines fishing operations by showing where the gear lands and where it is fishing. Provides information during fishing operations on location, depth, temperature, current, etc. Depth of up to 1.000m. Cost: 192.100 euros for a system consisting of 4 transponders.

Signatories

Acción Océanos
Ace Aquatec
Action for Protection of Animals Africa
Action For Dolphins
AEL Advocacy
Africa Network for Animal Welfare USA
African Marine Mammal Conservation Organization
Alexandria Turtle And Wildlife Rescue
Alianima
Anima International
Anima Naturalis
ANIMAL
Animal Advocacy Africa
Animal Advocates International
Animal Empathy Philippines
Animal Equality
Animal Friends Croatia
Animal Interfaith Alliance
Animal Kingdom Foundation
Animal Law Italia
Animal Nepal
Animal Policy International
Animal Rights Center Japan
Animal Society e.V.
Animals Aotearoa
Animals Don't Speak Human
Animal Welfare Advocates Association the Gambia
Animal Welfare and Environment Network for Tanzania
Animal Welfare Concern
Animals Australia
Animals Now
Apon Welfare
Aquatic Life Institute
ARAF-PLATEAU DOGON
ARBA
Arusha Society for the Protection of Animals
Aware
BC SPCA
Bristol Wave Seafoods
Catholic Concern for Animals
Congo Basin Conservation Society CBCS-Network
Coalition of African Animal Welfare Organisations
Compassion in World Farming
Conservative Animal Welfare Foundation
Crustacean compassion
The Dark Hobby
Deutscher Tierschutzbund
Dharma Voices for Animals
Dieren Bescherming
The Dorsal Effect
Dyrenes Alliance
Education for African Animals Welfare
Essere Animali
Estonian Union for the Protection of Animals (MTÜ)
Eestimaa Loomakaitse Liit)
Ethical Farming Ireland
FAADA
Feedback Global
Fish Welfare Initiative
F.R.E.E
Fórum Animal
Friends of Phillip
Fundacion defensa y derecho animal
Fundación Veg
Future For Fish
Ghana Animal Welfare Society
Green REV Institute
Humane Africa Trust
The Humane Global Network
The Humane League
Humánný pokrok
In Defense of Animals
Institute of Animal Law Asia
Invisible Animals (Nevidimi Zhivotni)
JC Mackintosh
Kitwe Animal Welfare Society
Kurdistan Organization for Animal Rights
Protection
L214
Lady Freethinker
The Last Cage
Lilongwe Society for Protection and Care of
Animals
Luv 4 all: Uganda
Marine Conservation Philippines
Mitchell & Cooper
National Council of SPCAs
Nepal Animal Welfare and Research Center
(NAWRC)
New Roots Institute
Nurture Imvelo Trust
The Oceans Need Us
Oikeutta eläimille
OIPA - International Organization for Animal
Protection
One Health and Development Initiative
ONG Sante Animale Afrique (SAA)
Optimar
Plataforma ALTO
Planet For All
Protección Animal Ecuador (PAE)
Proyecto ALA
PAZ
RENTAS
Rwanda Animal Welfare Organization (RAWO)
SAFCEI
SAFE
SafetyNet Technologies
Samayu
Sea First
Sentience
Sentient Media

Signatories

Shellfish Network
Shinkei Systems
Shrimp Welfare Project
Sibanye Animal Welfare and Conservancy Trust
Sinergia Animal
Somali Animal Welfare Society (SAWS)
Sống Thuần Chay
SPCA Montreal
SPCA New Zealand
SPCA Selangor
Tanzania Animals Protection Organization
Tanzania Animal Welfare Society (TAWESO)
Tikobane Trust
Todos Somos Animales
Tourists Against Trophy Hunting
University of Guilan
Utunzi Animal Welfare Organization
Vissenbescherming
Voices for Animals
Voters for animals rights
We Animals
Welfare Footprint Project (Center for Welfare Metrics)
Welfarm
West Africa Centre for the Protection of Animal Welfare
(WACPAW)
WTS