

A review of best practice mitigation measures to address the problem of bycatch in commercial fisheries

Indrani Lutchman

Independent Fisheries Consultant based in London

Abstract

The Marine Stewardship Council's Principles and Criteria require that fisheries should make use of fishing gear and practices to mitigate mortality of non-target species, minimise bycatch and reduce discards. In order to improve the MSC requirements and to ensure that MSC certified fisheries have considered best practice mitigation measures, a review of best practice measures implemented by national administrations and regional fisheries management organisations was undertaken. In addition, best practice mitigation measures identified by other fish certification schemes were also reviewed. The information has been used to inform the ongoing review of the MSC Standard and specifically Principle 2 which considers environmental impacts, including bycatch.

Citation: Lutchman I (2014) A review of best practice mitigation measures to address the problem of bycatch in commercial fisheries. *Marine Stewardship Council Science Series 2*: 1 – 17.

Date submitted: May 2013 | **Date published:** May 2014

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Introduction

The Marine Stewardship Council (MSC) Principles and Criteria¹ state that fisheries should make use of fishing gear and practices designed to avoid the capture of non-target species (and non-target size, age, and/or sex of the target species); minimise mortality of this catch where it cannot be avoided, and reduce discards of what cannot be released alive. However, the current assessment criteria provide little additional incentive for fisheries to minimise bycatch, potentially allowing fisheries to be certified with high levels of bycatch and without best practice mitigation measures included.

As part of a suite of possible changes the MSC are considering options for changes to the requirements associated with unwanted catches (including bycatch and discards), consistent with international best practice management, including effective data collection and monitoring programmes; and consistent with the original intent of the MSC's Principles and Criteria. In order to consider amendments to the 2012 assessment criteria, it was important to review the issue and establish a benchmark of what is global best practice for mitigating bycatch in a number of different contexts.

Definitions of bycatch

An important step to benchmarking best practice mitigation measures is the definition of the term bycatch. Currently there are a range of different definitions in the global context and therefore it is important to clearly define the term as this would also ensure clear guidance for scoring these criteria in the future.

A generic definition often used is that bycatch is the accidental capture of any species, of any size or sex that is not specifically targeted by fishing activity. Another common definition is that bycatch describes animals (fish and non-fish) caught unintentionally by fishing gear, including non-target species and undersized fish.

There are many variations of this definition in current literature on fisheries interactions and impacts. There are also a number of detailed and technical definitions of the term intended to clarify meanings in different contexts, or distinguish bycatch from its close relation, discards.

McCaughran (1992) defined bycatch as that portion of the catch which is returned to the seas as a result of economic, legal or personal considerations, plus the retained catch of non-target species. Whilst this definition is consistent with other definitions, this definition may not be the best one, as it lumps discarding with the economic motive to catch non-target species.

A meeting held in Tokyo in October / November 1996 (held under the auspices of the FAO) on the reduction of wastage in fisheries concluded that 'bycatch' can best be used as a generic term, applying to that part of the catch made up of non-target species or species assemblages but, when dealing with a specific portion of the catch, in fisheries management terms, it is better to give a more precise definition. In this context, the total catch is defined as that quantity taken by the fishing gear which reaches the deck of the fishing vessel (FAO, 1997). Discards are that portion thrown away at sea (for one reason or another). The remainder is the landed catch or retained catch (i.e. that which is brought ashore) which can be further sub-divided into target catch and incidental catch (bycatch) bearing in mind the volume, value, the incidence of species caught and the nature of the fishing operations. The same species can move from one category to another depending on size, market demand, season or other criteria; at the same time other species may be undesirable or of limited value.

¹ http://www.msc.org/documents/scheme-documents/msc-standards/MSC_environmental_standard_for_sustainable_fishing.pdf/view

Hall (2000) further defined bycatch as ‘that part of a capture that is discarded at sea, dead (or injured to an extent that death is the result). Capture is turn, means all that is taken in the gear. The capture can be divided into three components: (a) the portion retained because it has economic value (*catch*), (b) the portion discarded at sea dead (*bycatch*), and (c) the portion released alive (*release*) (Hall, 2000). According to Hall, bycatch happens for many different reasons, and has widely different characteristics, so it helps to analyze the problem by classifying bycatch further, for example, by their ecological or economic origin, and their significance. He further proposed that the classification could be based on eight different criteria that highlight some special characteristics of the problem, and in many cases point to likely approaches for its solution (Hall, 2000):

1. Spatial pattern of bycatch rates (more or less aggregated in space);
2. Temporal stratification (more or less `aggregated in time');
3. Level of control (controllable or uncontrollable by the fishers);
4. Frequency of occurrences (rare or common);
5. Degree of predictability (predictable or unpredictable);
6. Ecological origin of the bycatch (species associated with the target or random encounters);
7. Level and type of impact;
8. Legal or economic considerations.

Bycatch is sometimes defined as “discarded catch plus incidental catch” where incidental catch is considered to be retained non-target species. However, if target species (juveniles) are discarded this may cause confusion as target species are not considered as bycatch. Bycatch may contain a variety of species, from marine mega fauna to lower trophic level species that are critical for the maintenance of the structure and functioning of marine ecosystems and the continued provision of marine ecosystem services. Vulnerable species groups subject to bycatch include seabirds, sea turtles, marine mammals, elasmobranchs (sharks, skates and rays) and other fish species (Gilman, 2011).

The MSC defines bycatch as organisms that have been taken incidentally and are not retained (usually because they have no commercial value). This implies that bycatch also refers to non-fish species including sea sponges, turtles, and cetaceans as well as fish and other species with no commercial value.

Review of bycatch mitigation measures

The International Guidelines on Bycatch Management and Reduction of Discards (FAO, 2011) were developed and adopted by the FAO Technical Consultation held in Rome from 6 to 10 December 2010. They are intended to assist States and Regional Fisheries Management Organisations/Arrangements (RFMO/As) in the management of bycatch and reduction of discards in conformity with the FAO Code of Conduct for Responsible Fisheries.

The FAO Guidelines provide a list of tools which States and RFMO/As should consider in their efforts to address these problems. Such tools include, *inter alia*:

- Input and/or output controls;
- Improvements to the design and use of fishing gear and bycatch mitigation devices;
- Spatial and temporal measures;
- Limits and/or quotas on bycatches;
- Bans on discards, where applicable, providing that the retained catch cannot be released alive and is utilized in a manner that is consistent with the Code of Conduct for Responsible Fisheries; and incentives for fishers to comply with measures to manage bycatch and reduce discards.

More details on the implementation of these measures are provided in [Appendix 1](#).

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In addition to the measures listed above, the FAO guidelines recommend that States and Regional Fisheries Management Organisations (RFMOs) should seek to eliminate or adjust regulatory measures that provide incentives that may undermine bycatch management and discard reduction measures.

In addition to the recommended list of mitigation measures (FAO, 2010), a range of mitigation measures to address the problem of bycatch of non-target species in specific fisheries have been identified as best practice mitigation measures. These measures include streamer lines which were designed to reduce the bycatch of sea birds, turtle excluder devices (TEDs) used to reduce the bycatch of turtles in shrimp trawls and other modifications to fishing techniques that have resulted in significant bycatch reduction.

A review of best practice mitigation measures was undertaken to inform the MSC review process on the bycatch Standard. This included a review of measures:

- At the regional level - taken by RFMOs to address bycatch mitigation
- At the national level – taken by governments to address bycatch issues in exclusive economic zones (EEZs) and territorial waters
- At the technical level – a review of different gear types targeting different species (e.g. demersal long lines for toothfish, purse seines for tuna).

Bycatch criteria and standards in a list of ecolabelling schemes established by independent organisations including the Monterey Bay Aquarium and the Blue Ocean Institute are also listed to provide a better understanding of the range of approaches to defining best practice.

The information presented in these reviews was obtained from research and other publications by independent researchers, academics, organisations (e.g. intergovernmental and NGO) as well as direct contact with individuals in specific organisations.

At the regional level

The conservation and management regimes of seven RFMOs were reviewed, in particular their approach and measures for addressing bycatch and discards in their specific fisheries. In all cases conservation measures are based on the advice of a scientific body under the auspices of the RFMO with a mandate for providing recommendations on target, non-target and bycatch species, as well as data collection and compliance. Due to the nature of the fisheries including the species targeted and the gear used, the issues relating to bycatch and the specific action required varies. More specific details on the bycatch mitigation measures are provided in ([Appendix 2](#)), with additional information (where available) on the efficacy of these measures in addressing the problem and best practice.

Best practice mitigation measures adopted by RFMOs include technical modifications to gear and fishing operations including:

- Use of tori poles and streamer lines in demersal and pelagic longlines
- Design and use of the chute for deploying demersal long lines
- Night setting (specifically for demersal and pelagic longlines)
- Discharge of offal at the opposite side to deployment of fishing gear
- Prohibition of the use of fish aggregating devices (FADs) during purse seine fishing for tuna
- Use of pingers as a deterrent for cetaceans
- Measures to disentangle and release cetaceans
- Use of turtle excluder devices (TEDs).

In addition RFMOs such as CCAMLR and NEAFC have adopted a range of conservation measures to address bycatch of specific species such as skates and rays in the Southern Ocean and deep sea species such as sharks or sponges and corals in the North East Atlantic. Additional best practice mitigation measures include:

- Bycatch quotas for the non-target species
- Move-on rule to limit the impact on species in geographical areas (CCAMLR)
- Prohibition of fishing in VMEs (NEAFC and CCAMLR)
- Seasonal and temporal closures to protect seabirds during feeding and breeding seasons
- Mandatory requirements for observers at sea (all RFMOs)
- Data collection on bycatch species (including NAFO, tuna RFMOs, CCAMLR).

At the national level

At the national level, there are some key countries that lead with their approach to dealing with the bycatch and discard problems and implementation of best practice mitigation measures. These include Canada, Iceland, Norway, Australia and the US. [Appendix 3](#) presents more detailed information on the best practice mitigation, technical and management measures that are in place at the national level to address bycatch and discards. Canada is developing a national bycatch policy but is implementing a range of best practice mitigation measures in fisheries in the Atlantic to fisheries on the Pacific (west) coast using a variety of gears for a variety of species. Iceland and Norway implement a no discard policy which requires the landing of all species caught (in mixed fisheries) but also implements mitigation measures for seabirds and cetaceans. The US also uses a variety of best mitigation measures include non-traditional mitigation measures such as the use of catch shares and other modified gears for excluding turtles (turtle excluder device).

Best practice mitigation measures by gear type and fishery

[Appendix 4](#) presents a list of selected best practice mitigation measures to reduce the bycatch and discards in specific fisheries / gear types.

Review of criteria and requirements for bycatch standards in a selection of ecolabel schemes

A review of ecolabels schemes for capture fisheries (Sainsbury, 2010) highlights that bycatch and discard are given high prominence in scoring fisheries performance. In the case of threatened, endangered and protected species, bycatch of these species is required to be low or zero to achieve high scores ([Appendix 5](#)). In most other situations, mitigation plans and measures are required. Most ecolabel schemes score general bycatch on the basis of the weight or number of bycatch relative to retained catch. High scores require no or low bycatch rates with 10% being the benchmark for a high score in several systems. About 100% bycatch relative to catch gives a medium score in some systems with higher bycatch percentages than these giving low scores. In all cases, mitigation plans and measures are supported.

A review of the criteria and standards applicable to bycatch by other ecolabel and certification schemes is presented in [Appendix 5](#) and highlights the following:

- Criteria and standards vary among ecolabels with most referring to the FAO guidelines on bycatch and discard management
- No eco-label scheme is explicit about best practice, however, some ecolabels have more specific criteria and scoring procedures
- For example, the Monterey Bay Aquarium (MBA) Seafood Watch has prescriptive scores that can be adjusted depending on the level of compliance with the criteria.
- Other schemes such as the Alaskan Seafood Marketing Institute Ecolabel base their standards on the FAO guidelines and include general requirements for mitigating bycatch and discards.

Conclusion

The bycatch of non-target species in commercial fisheries remains an issue for commercial fishermen and fisheries managers. At a technical, national and international level, there have been major developments mitigating bycatch of specific species, for example, seabirds and turtles and in specific fisheries, for example, shrimp and tuna fisheries. The increasing number of mitigation measures continues to grow and improve in design, effectiveness both in terms technical specifications and financial terms. In this regard, there is a growing need to continue to identify best practice mitigation measures and to facilitate the exchange of these measures at the regional level through RFMO collaboration e.g. in the tuna RFMOs and at the international level through the FAO special guidelines and other expert groups, for example, the Agreement for the Conservation of Albatross and Petrels (ACAP, 2013). The integration of criteria on bycatch in eco-labelling schemes adds impetus to the ongoing efforts by countries and entities worldwide to address the problem of bycatch in commercial fisheries. The current review of the MSC Standard and criteria on bycatch has led to improvements and a tightening of the MSC Standard taking into account best practice mitigation measures and further contributed to sustainability of fishing practices.

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Appendix 1. Recommended list of mitigation measures to address bycatch and discards (FAO, 2010)

Fisheries management measure	Recommended actions
Inputs and output controls	Control fishing effort and capacity in order to reduce bycatch and discards, especially in those fisheries where it is known that excess capacity and fishing effort has resulted in significant bycatch and discards
Technical modifications	<p>Changing the design, rigging and deployment of fishing gear (e.g. mesh size, hook size, aimed trawling);</p> <p>Installing bycatch reduction devices (e.g. turtle excluder devices, sorting grids, square mesh panels, tori lines on longlines);</p> <p>Using operational techniques during fishing to reduce encounters with bycatch (e.g. the back down manoeuvre during purse-seining);</p> <p>Using equipment, practices and handling techniques that increase the probability of survival of the released catches;</p> <p>Using an alternative fishing gear that results in lower bycatch;</p> <p>The appropriate use of integrated vessel and fishing gear position monitoring and habitat mapping systems.</p>
Spatial and temporal measures	<p>The use of adaptive spatial closures to reduce bycatch problems;</p> <p>Encourage information-sharing among fishers and managers to identify areas/times of bycatch problems so that fishers effectively avoid them;</p> <p>Closure decisions based on the best available scientific advice;</p> <p>The feasibility of introducing a requirement to move away from areas where significant bycatch problems occur.</p>
Limits and/or bycatch quotas	As part of a fisheries management plan, States and RFMOs should consider the establishment of no-discard regimes, wherever applicable, and individual and fleet-wide limits on bycatch in those fisheries where bycatch is unavoidable. The FAO guidelines point to the fact that setting limits on bycatch must be supplemented with good control and monitoring to ensure that these measures have the desired impact. In addition, it is recommended that these limits should be precautionary when there is limited information on the impacts of bycatch and discarding.
Economic incentives	<p>Access to or restriction from fishing opportunities can be a strong economic incentive for compliance with bycatch mitigation measures;</p> <p>In accordance with international rules on subsidies and duties, the costs to fishers for installation of bycatch mitigation technologies could be lessened, where appropriate, through the application of grants/loans and preferential treatment on duties and taxes for investment in such technologies:</p> <p>These incentives can be used to encourage fishers and ensure compliance with management measures to address bycatch and discards.</p>

Appendix 2. List of best practice mitigation measures implemented at a regional level

Geographical region	Management body ²	Bycatch issue	Mitigation measures	Observer programme	Data Collection	Additional information
South Atlantic	CCAMLR ³	Sharks, rays, seabirds.	Move on rule closed areas/seasons; Streamer lines; Night setting; Offal disposal	Yes	Yes (specifically on skates and rays)	Requirement to reduce bycatch of all species
Northwest Atlantic	NAFO ⁴	Sharks, turtles, skate, list of benthic species in Vulnerable Marine Ecosystems (VMEs)	Prohibition of bottom trawling in sensitive habitats (closed areas); Banned shark finning and improved sea turtle protection; Regulation of fisheries for elasmobranchs e.g. Thorny skate	Yes	Yes	
Northeast Atlantic	NEAFC ⁵	Deep sea sharks, deep water corals basking sharks, porbeagle	Prohibition of fishing on deep sea sharks; Prohibition on fishing in Hatton Rockall Vulnerable Marine Ecosystem (VME) Prohibition on fishing in Edora Bank VME Prohibition of directed fishing on basking sharks, porbeagles, spurdogs.	Yes	Yes	In addition to the current measures, there is a ban on discarding deep sea species including species of deep sea sharks and some species of skate including Round and Arctic skate
Western central Pacific	WCPFC ⁶	Sharks, turtles and seabirds		Yes	Yes	
Indian Ocean	IOTC ⁷	Sharks, seabirds, turtles		Yes	Yes	

² CCAMLR - Commission for the Conservation of Antarctic Marine Living Resources; NAFO - Northwest Atlantic Fisheries Organization; NEAFC - North East Atlantic Fisheries Commission; WCPFC - Western & Central Pacific Fisheries Commission; IOTC – Indian Ocean Tuna Commission

³ www.ccamlr.org

⁴ www.nafo.int

⁵ www.neafc.org

⁶ www.wcpfc.org

⁷ www.iotc.org

Appendix 3. Selected best practice mitigation measures to address bycatch of non-target species implemented at a national level

Country/ Economic entity	Management Authority	Bycatch species	Mitigation Measures	Legislations/policy	Data collection/ Observer programme
USA	National Marine Fisheries Service (NFMS) ⁸	Mammals (porpoises, dolphins, pilot whales in fisheries in the Northeast US); Turtle bycatch is highest in the Southeast fisheries in the Gulf of Mexico; and seabird bycatch is highest in the Alaskan fisheries	In Northeast fisheries: “Weak links” are required on the surface system of gillnet and trap/pot fishing gear to reduce the risk of whales becoming entangled or killed. Chain mats are required in the Atlantic sea scallop dredge fishery to reduce the severity and injury of sea turtle interactions. Seasonal management areas are implemented under the Gulf of Maine Harbor Porpoise management plan	US Endangered Species Act (ESA) Marine Mammal Protection Act (MMPA) Re-authorised Magnuson Stevens Act (MSA)	Yes Yes
			In the Southeast fisheries: Turtle excluder devices (TEDs) have been required in all shrimp trawls (with limited exceptions) since the mid-1990s. Gear regulations are in the Atlantic pelagic longline fishery for Highly Migratory Species have reduced interactions with endangered and threatened sea turtles		
Canada	Department of Fisheries and Oceans (DFO) ⁹	Cetaceans in bottom gill net fisheries (Atl. Canada); seabirds in demersal long lines; turtles & sharks in pelagic trawls	Streamer lines for the bycatch of seabirds and the secondary measures; Turtle excluder devices	Fisheries Act Sustainable Fisheries Framework (SFF) National implementation of International Plan of Action (IPOA) for seabirds Canada's bycatch policy is under development	Yes Yes

⁸ http://www.nmfs.noaa.gov/by_catch/index.htm

⁹ <http://www.dfo-mpo.gc.ca/fm-gp/peches-fisheries/fish-ren-peche/sff-cpd/bycatch-policy-prise-access-eng.htm>

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Country/ Economic entity	Management Authority	Bycatch species	Mitigation Measures	Legislations/policy	Data collection/ Observer programme
Australia	Australian Fisheries Management Authority (AFMA) ¹⁰	Various species depending on fisheries	Mitigation measures for seabirds including streamer lines, closed areas	Australia Bycatch and discard program Bycatch action plans for individual fisheries	Yes Yes
Norway	Ministry of Fisheries and Coastal Affairs ¹¹	Non-target fish	No discard policy; discard ban	Marine Resource Act 2008	Yes Yes
Iceland	Icelandic Ministry of Fisheries and Agriculture ¹²	Non-target fish	ITQ system, discard ban, closed areas and prohibition of fishing gear in VMEs	Fisheries Management Act (1990)	
New Zealand	Ministry for Primary Industries ¹³	Non-target nonfish species including seabirds in trawl fisheries; sealions in squid fisheries	Quota management system -no discard policy; underwater chute for deploying hooks in the long line fisheries; marine reserves; excluder devices for sealions; tori lines on trawls for seabirds	New Zealand Fisheries Act 1996	Yes Yes
EU	DG Mare ¹⁴	Juvenile fish; non-target fish; seabirds, cetaceans, other marine organisms	A mix of technical modifications to gear; policy and legislation including discard bans and specific mitigation measures: Square mesh panels in beam trawls Modifications to cod-ends to allow escape of small fish Mandatory use of pingers on static gill nets and entangling nets in all European waters streamer lines for mitigation of seabird mortality in pelagic longlines in the Mediterranean closure of areas (spatial and temporal)	CFP Basic Regulation (2013) CFP (technical regulations for NE Atlantic, Baltic Sea region and Mediterranean.	EU data collection programme

¹⁰ http://www.afma.gov.au/wp-content/uploads/2010/06/is_env_bycatch-prog_feb08_20080417.pdf

¹¹ <https://www.fisheries.no>

¹² <http://www.fisheries.is/management/government-policy/responsible-fisheries/>

¹³ <http://www.fish.govt.nz/en-nz/Environmental/default.htm>

¹⁴ http://ec.europa.eu/dgs/maritimeaffairs_fisheries/index_en.htm

Appendix 4. Best practice mitigation measures by fisheries and gear type

Fisheries	Gear type	Bycatch	Mitigation measures	Implemented in fisheries
Tuna fisheries/small pelagics (Gilman, 2011)	Purse seines	Cetaceans Turtles	Restrict setting of FADs or other aggregating devices Prohibition of night sets Conducting backdown after the dolphins are captured Use of the 'medina dolphin safety panel' Not setting on turtles Deploying boats to assist with the release of turtles Turtle excluder devices	IATTC SPREFO
Toothfish/Deepwater species (SC-CCAMLR, 2006)	Demersal longlines	Seabirds Sharks/skates/rays	Night setting Under-water setting of hooks Ban on discharging of offal off the side of boats Bird scaring devices on the deck e.g. tori poles Move on rule	CCAMLR
Large pelagic fisheries (Gilman,2011)	Pelagic long lines	Seabirds Turtles	Night setting Under-water setting of hooks Ban on discharging of offal off the side of boats Bird scaring devices on the deck e.g. tori poles Wider hooks with large fish bait ¹⁵ Deeper setting to deploy hooks	IOTC
Shrimp fisheries (Kennedy, 2007)	Pelagic trawls	Turtles	Avoiding hotspots Not using FADs or other aggregating devices Turtle excluder devices	US (Gulf of Mexico fisheries)
Small pelagics (Hall, 2000)	Gillnets	Cetaceans	Pingers Weak lines on buoys to break away before entanglement	US

¹⁵ In instances where this modification of bait from squid to large fish has been made, the bycatch of turtles had declined to between 55-90%

Appendix 5. Selected list of ecolabels and bycatch requirements and criteria

Organisation	Short description	Scorecard/ecolabel	Requirement on bycatch
Icelandic Responsible Fisheries Eco-label ¹⁶	This certification programme aims to provide the fishing industry with a ‘Certification of Responsible Fisheries Management’ at the highest level of market acceptance. Certification to requirements under the Programme is intended to demonstrate a commitment to customers and consumers of responsible fishing by fishermen; responsible fisheries management by the authorities and the provenance of Icelandic fish.	Label only for Icelandic fisheries	In the fisheries specification the following requirements are included: 1.2.4. For the stock under consideration, the determination of suitable conservation and management measures shall include or take account of total fishing mortality from all sources in assessing the state of the stock under consideration, including: 1.2.4.1 Estimates of discards; 1.2.4.2 Unobserved and incidental mortality, 1.2.4.3 Unreported catches and catches in other fisheries. Data collection in relation to discards is mentioned in pt.2.2.27. in the specification. (<i>Certification of the Icelandic cod fishery in 2010</i>)
Naturland ¹⁷	Naturland, founded in 1982, provides an eco-label for a wide range of organic agriculture, including aquaculture. It has a well-developed process of certification and accreditation. This includes third party certification bodies, accreditation bodies and objections procedures, with frequent ISO audits to ensure the accreditation/ certification systems meet international requirements. In 2006, Naturland extended its scope to include sustainable inland and marine capture fisheries with the ecolabel Naturland Wildfish (Sainsbury,2008)	Naturland certification is based on project-specific management conditions and procedure. In addition, it is based on ecological, social and economic as well as legal conditions.	Bycatch requirements are under the heading ‘ecology’. There are also social and economic conditions and legal. Specifically in relation to bycatch, practices which are generally deemed as detrimental or critical from an ecological point of view are prohibited. These include the following regulations in addition to the project-specific management conditions relating to: Catching marine mammals and ocean turtles Catching sharks for their fins (“finning“) Beam trawl fishing as well as demersal trawling on highly structured sea beds <ul style="list-style-type: none"> demersal trawling without suitable escape hatches to keep bycatches to a minimum.

¹⁶ <http://www.responsiblefisheries.is/>

¹⁷ http://www.naturland.de/fileadmin/MDB/documents/Richtlinien_englisch/Naturland-Standards_Sustainable-CaptureFishery.pdf

A review of best practice mitigation measures to address the problem of bycatch in commercial fisheries

<p>Friends of Sea¹⁸</p>	<p>Friend of the Sea is a non-profit non-governmental organisation (NGO), whose mission is to conserve the marine habitat.</p>	<p>A certification project for products originating from both sustainable fisheries and aquaculture. Certified products from all continents include most of the traded species, fishmeal, fish feed and Omega-3 fish oil.</p>	<p>Friends of the Sea follow the FAO Guidelines and have a set of criteria of which two relate directly to bycatch:</p> <ul style="list-style-type: none"> • A requirement that the fishery should generate a maximum of 8% discards • No bycatch of endangered species <p><i>(Over 85 fisheries in all oceans have been found to be compliant with Friend of the Sea criteria. Some fisheries have not met the criteria completely but have met some specific conditions and were certified.)</i></p>
<p>Marine Conservation Society¹⁹</p>	<p>The Marine Conservation Society (MCS) Good Fish Guide and Fishonline is designed to help you identify fish more resilient to fishing pressure, from well-managed sources and caught using methods that minimise damage to wildlife and habitats, allowing you to make the best seafood choices</p>	<p>Uses a traffic light system- with scores from 1-5; fish with a score of 1 gets a green light and fish with a score of 5 gets the red light; a score of 3 is amber. Scores between 0 (Green smiley face) where there is no impact and 1 (red sad face) for high impact,</p>	<p>Bycatch is considered under the heading of 'impacts of fishing gear' as impact on non-target species Defines bycatch as other fish species or non-fish species such as marine birds, turtles or mammals. Recognises the extent of the impact on non-target species depends on a number of factors, such as the target fish species and the area in which the fishing activity is taking place. For example, pelagic or mid-water trawling is associated with unacceptable levels of dolphin bycatch in seabass fisheries, whereas when fishing using the same method for herring no such problem encounters. <i>(Mitigation measures for each gear type are also taken into account in overall score of fishing gear)</i></p>

¹⁸ <http://www.friendofthesea.org/>

¹⁹ http://www.mcsuk.org/downloads/fisheries/176-2012_Wild-Capture%20Methodology%20Handbook_Nov2012_LowRes.pdf

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<p>Alaska Seafood Marketing Institute (ASMI)²⁰</p>	<p>The Institute Ecolabel is based on a set of criteria which are found in the following FAO documents comprise the FAO-Based Responsible Fisheries Management Certification Conformance Criteria:</p> <ul style="list-style-type: none"> • The FAO Code of Conduct for Responsible Fisheries 1995 • The FAO Guidelines for Eco-labelling of Fish and Fishery Products for Marine Capture Fisheries 2005/2009 • The FAO Fisheries Circular No. 917 J. Caddy, October 	<p>There are four generic scores: pass - where full conformance with a criteria is observed Minor – where there are minor gaps which need to be fulfilled Major – where information or evidence required for a clause is met only to a limited degree Critical – where there is complete absence of conformity with a clause</p>	<p>Bycatch is include under two criteria:</p> <ul style="list-style-type: none"> • Scientific assessments – Ecolabel criteria 29.1-29.3 which requires that data be collected on all retained, bycatch and discarded species. • Serious impacts on the ecosystem – Ecolabel criteria 31.1. which requires that appropriate measures ne taken to • minimisation of catch, waste and discarded species <p><i>(Only Alaskan fisheries have been certified to date.)</i></p>
<p>Environment Defense Fund (EDF)²¹</p>	<p>US-based NGO with a focus restoring oceans based on good science, partnerships and using market incentives</p>	<p>Has a Seafood selector guide which aims to promote sustainable and healthy fisheries. Fish are categorised into three categories; eco-ok, eco-best and eco-worst.</p>	<p>Scorecard based on the MBA standards. <i>(Fish includes species from the New England groundfish fisheries; Pacific rockfish fisheries and Gulf Reef fisheries.)</i></p>

²⁰ <http://www.alaskaseafood.org/>

²¹ <http://seafood.edf.org/buying-fish-what-you-need-know>

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Blue Ocean Institute ²²	Blue Ocean Institute is a US NGO with consumer awareness campaign - sustainable seafood choices. They produce a Guide to Ocean Friendly seafood.	Uses a scorecard which is based on five criteria under which scores are allocated: 1. Life History 2. Abundance 3. Habitat and fishing gear impacts 4. Management 5. Bycatch	A bycatch scoring system is used as below. Level of bycatch relative to targeted landings and nature of bycatch: +1 High: Bycatch > targeted landings; drives decline in bycatch species; endangers a species or prevents recovery of an endangered species +2 Moderate: Bycatch is 10-99% of targeted landings and does not drive the trend in abundance of the bycatch species; or level of bycatch unknown or unmonitored +3 Low: Bycatch <10% of targeted landings POINTS OF ADJUSTMENT Bycatch of threatened, endangered, or protected species (TEP) and management response: - 0.5 TEP species are regularly caught +0.5 Specific measures taken to reduce bycatch of TEP species Bycatch of nontarget and undersized target species in this fishery or bycatch of this species in other fisheries and management response: - 0.5 Bycatch high and no management measures taken to reduce it +0.5 Measures (e.g., gear changes) are in place over a major portion of species range, to reduce bycatch of these species Bycatch of depleted target or non-target species (not including TEP species): - 0.5 Bycatch weakens recovery +0.5 Bycatch is not believed to weaken or undermine recovery of these species Worst/best case: - 0.5 Species is being driven to extinction as a result of fishery, e.g., bycatch of albatrosses in toothfish fisheries +0.5 Fishery is very selective, e.g., harpoon fishery for swordfish
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²² http://blueocean.org/files/Seafood_Guide.pdf

Monterey Bay Aquarium²³

Seafood Watch uses five sustainability criteria, corresponding to these guiding principles, to evaluate capture fisheries for the purpose of developing a seafood recommendation for consumers and businesses. These criteria are:

1. Inherent vulnerability to fishing pressure
2. Status of wild stocks
3. Nature and extent of discarded bycatch
4. Effect of fishing practices on habitats and ecosystems
5. Effectiveness of the management regime

A green (G), yellow (Y) or red (R) rank is assigned to each criterion, with green being the most sustainable. The rank for each criterion is assigned on the basis of a series of factors relevant to that criterion, with each factor also given a green, yellow or red rank.

A species is green if it has three or more green criteria and the remaining criteria are not red.

A species is yellow if:

- 1) Criteria “average” to yellow
- 2) There are four green criteria and one red criteria
- 3) Stock Status and management criteria are both ranked yellow and remaining criteria are not red.

A species is red if

- 1) It has a total of two or more red criteria
- 2) It has one or more Critical Conservation Concerns.

Criterion 2:

The fishery minimizes bycatch. Seafood Watch defines bycatch as all fisheries-related mortality or injury other than the retained catch. Examples include discards, endangered or threatened species catch, pre-catch mortality and ghost fishing. All discards, including those released alive, are considered bycatch unless there is valid scientific evidence of high post-release survival and there is no documented evidence of negative impacts at the population level. Fishing mortality does not threaten populations or impede the ecological role of any marine life.

Fishing mortality should be appropriate given each impacted species’ abundance and productivity, accounting for scientific uncertainty, management uncertainty and non-fishery impacts such as habitat degradation.

Factor 2.1 Inherent resilience of the bycatch and other retained stocks

Ensure fishing mortality and other management measures are appropriate for the inherent resilience of all bycatch stock(s).

Factor 2.2 Health of bycatch and other retained stocks
Stock abundance and size structure of all main bycatch species/stocks is maintained at a level that does not impair recruitment or productivity.

Factor 2.3 Mortality caused by this fishery on bycatch and other retained stocks.

Fishing mortality is appropriate for the current state of all main bycatch species/stocks.

Factor 2.4 Secondary factor: discards and bait use
Fishery optimizes the utilization of marine resources by minimizing post-harvest loss and by efficiently using marine resources as bait.

²³ http://www.montereybayaquarium.org/cr/cr_seafoodwatch/sfw_eco_certification.aspx