

Aquaculture ratings methodology handbook

Version 4 2022



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4. INTRODUCTION

This document provides in depth discussion of how MCS assesses the environmental performance of various fish farming production methods and species. It is aimed at internal MCS assessors and staff, consultants, seafood businesses and other professionals requiring a thorough understanding of the MCS farmed seafood ratings methodology.

Please click:

- [Here](#) to see an **Introduction to MCS Seafood Ratings**; and
- [Here](#) see the **MCS Wild Capture Seafood Ratings Methodology**.

If you have any questions or specific queries about MCS seafood ratings or you would like to comment on or contribute to information in the Good Fish Guide please email MCS at: ratings@mcsuk.org

5. OVERVIEW OF RATINGS PROCESS

The Unit of Assessment (UoA) for the MCS aquaculture methodology is the aquaculture production system within a region.

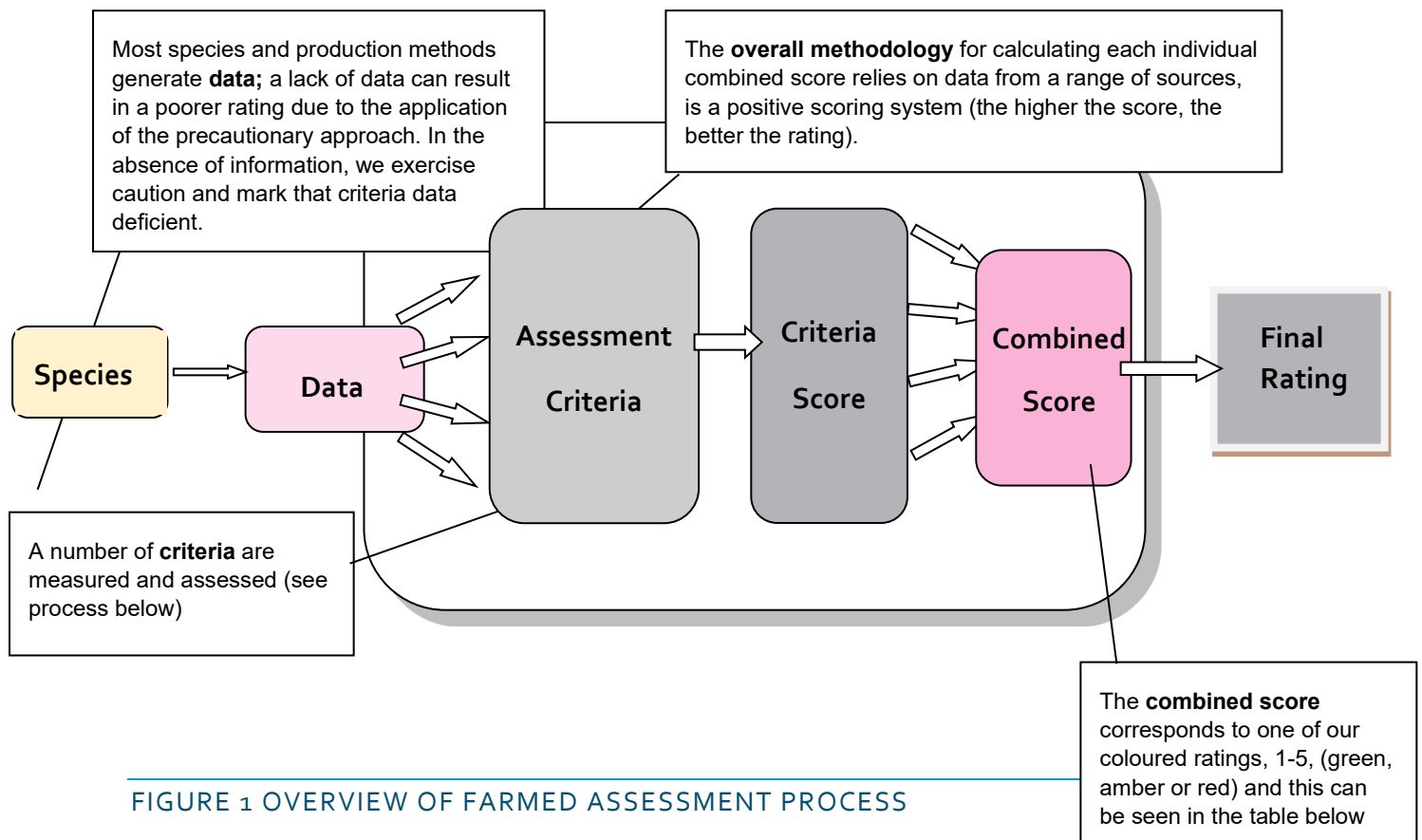
The region may be defined at country level (e.g. Vietnam) or at the regional level (e.g. Mekong Delta) and further determined by the scope and geographical application of regulations and management practices in the area. Each UoA is further defined by production method and species.

For example:

Scotland – Open Marine Net Pen – Atlantic salmon – GlobalGap certified.

We do not assess or rate individual farms or producers; we also do not rate companies. Farm/producer level assessments can only be carried out by certification accreditation bodies (CAB's) against independent production standards. Standards such as those held by the Aquaculture Stewardship Council (ASC); GlobalGap; Global Seafood Assurance Best Aquaculture Practice (GSA BAP) and organic standards such as Soil Association, Naturland or European organic standard.

A rating is a tool that communicates the relative environmental performance of one production system against specific criteria, which in the opinion of MCS, represent the key issues of environmental impact and concern in aquaculture. An overview of the ratings process for the unit of assessment is presented in the figure below (Figure 1).



The criteria against which we measure sustainability are:

- **Feed resources** – traceability, sustainability of sourcing and inclusion of both marine and non-marine feed ingredients.
- **Environmental Impacts and Interactions** – the impacts of production on: freshwater; habitats; chemical use and water quality; impacts on other species both indirectly and directly, including sourcing of juveniles and cleaner fish; parasite and disease impacts; escapes and predator control.
- **Fish welfare** – the presence of welfare standards, including slaughter.
- **Regulations and Management** – area based management/zoning, regulations and the effectiveness of their enforcement and certification status of the UoA.

The relationship between the combined criteria score and the overall rating is presented in the table below (Table 1).

TABLE 1 RELATIONSHIP BETWEEN COMBINED SCORE AND OVERALL RATING

Combined criteria score	Overall Rating	
9 or more	Dark Green (Best)	Best choice
Between 4 - 8	Light Green (Good)	
Between -2 and 3	Yellow (OK)	Think
Between -10 and -3	Orange (Requires improvement)	
-11 or less or Critical fail	Red (Avoid)	Fish to Avoid

No weighting of criteria or assessment questions is used in the aquaculture assessment methodology. This is due to the diversity of production systems and species each having their unique environmental impacts. The number of criteria questions within each section of the methodology reflects the priority of the issues in relation to MCS Conservation Strategy:

- Feed Resources and Use – 26.5%
- Environmental Impacts and Interactions – 47.5%
- Fish Welfare – 5%
- Management and Regulations – 21%

CRITICAL FAIL

For some species the impact of sourcing juveniles from critically endangered stocks is of such concern that regardless of the environmental performance in other areas, a Critical Fail and therefore Fish to Avoid is the only appropriate advice.

TABLE 2. ASSESSMENT SECTION SCORING

Section	Scoring Range
Feed Sourcing and Use	6 to -7
Ecological Impacts and Interactions	8 to -17/ CRITICAL FAIL
Fish Welfare	1 to -1
Regulation and Management	6 to -4

6. CRITERIA CATEGORY DESCRIPTORS AND VALUES

The complexity of the methodology lies in the allocation of values to assessment criteria. We allocate values for each question, the higher the score the better the Unit of Assessment performs.

CRITERION 1. FEED SOURCING AND USE

1.1 RATIONALE

Growth in aquaculture is dependent on natural resources, such as freshwater, space and proteins and oils to provide feeds. The production and subsequent consumption of feed incorporating marine proteins and oils from poorly managed feed fisheries is a crosscutting issue of global concern across many species as aquaculture production continues to expand.

The primary area of concern regarding feed fish management and feed production is with many of the Asian countries supplying the UK with popular farmed species such as warm water prawn and pangasius. Many South East Asian fisheries are unregulated, poorly managed and heavily overexploited¹. The increasing demand on aquaculture to fill the “the fish gap”; combined with the static nature of wild capture fisheries which are at best already exploited to their maximum capacity to supply fish for marine proteins and oils for feed production, makes it imperative that fish for feed are managed responsibly and exploited sustainably. For aquaculture to continue to expand to meet increasing demand for seafood, marine proteins and oils will need to be augmented from an array of non-marine ingredients such as vegetable proteins and oils; processed animal proteins (PAP's), algae oils and/or other emerging innovative ingredients such as insect meal.

1.2 AIMS

To achieve responsible production of farmed fish and work towards greater sustainability the fish farming industry must be underpinned by a well-managed, traceable feed supply that is used responsibly. Within the feed resource and use section of this assessment methodology MCS are encouraging and rewarding the following actions:

- The use of sustainable marine proteins and oils in the manufacture of commercial aquaculture feeds.
- The use of sustainable sources of soy products and palm oil given the environmental impacts of their production.
- A partial substitution diet that both maintains farmed fish health whilst delivering the health benefits of marine proteins and oils to as many consumers as possible
- The farming of aquaculture species that have a low dependency on marine proteins and oils and therefore represent a net gain in fish protein.

¹ Leadbitter, D. 2013. A Risk Based Approach for Promoting Management Regimes for Trawl Fisheries in South East Asia. *Asian Fisheries Science* 26 (2013): 65-78

- The maximization of the use of trimmings from human consumption fisheries as a source of marine proteins and oils

1a. Does the Unit of Assessment in this country/region rely on formulated feeds that include, but are not limited to: marine/soya/palm proteins and oils?

Answer Options	Answer Descriptors
Yes	Proceed to question 1B
No	Award 6 points and proceed to Section 2.

1b. Are soy (and soy derivatives) products and/or palm oils used and responsibly sourced?

Score	Answer Options	Examples and Answer Descriptors
1	Any soy and/or palm used is certified as responsible sourced, verified by audit* Soy and palm not used	*Rainforest Alliance 2020 Sustainable Agricultural Standard ¹ *Roundtable for Sustainable Palm Oil (RSPO) ² *RTRS Standard for Responsible Soy Production V4.0 ³
0	Any soy and/or palm is traceable to countries that are deforestation free. **	**Soy schemes that are compliant with the FEAC Soy Sourcing Guidelines 2021 ⁴ meet this requirement.
-1	No data available on soy/palm content. Any soy and/or palm used is untraceable	

1c. Are wild capture fisheries that provide the marine protein and oil components of the feed for the species in this UoA, sourced sustainably or responsibly?

Score	Answer Options	Examples and Answer Descriptors
2	75% or more of the marine protein and oil components of the feed are derived from fisheries that are independently certified as being sustainable, verified by audit* and/or derived from byproducts from certified fisheries and/or certified fishmeal and fish oil production plants**.	* Member of ISEAL and compliant with ISEAL codes, with standard criteria for low trophic species and ecosystem impacts. Fisheries are the unit of certification. (currently only MSC) ** This would mean that there is a public commitment or certification criteria that states that the marine proteins and oils are either MSC certified, or byproducts from MSC certified fisheries and/or from MarinTrust certified production plants.
1	There is standard criteria or a policy in place within the supply chain, that ensures at least 75% (90% for salmon)* of marine proteins and oils are responsibly sourced, verified by audit**	*These percentages would automatically include any % that is MSC certified *Currently only marine proteins and oils from MarinTrust certified fishmeal and fish oil production plants.

		NB. For any proteins and oils from a FIP/Improvers Programme see MCS FIP guidance document
0	There is standard criteria or a policy in place within the supply chain, that requires at least 50% of marine proteins and oils to be responsibly sourced, verified by audit* No marine ingredients are used.	*Currently only marine proteins and oils from MarinTrust certified fishmeal and fish oil production plants. NB. For any proteins and oils from a FIP/Improvers Programme see MCS FIP guidance document
-1	Feed is traceable to a feed manufacturer, and the manufacturer(s) have a public facing responsible sourcing policy in place; however, the implementation of this is not verified by third party audit*. Less than 50% of feed is responsibly sourced	*This would include a Fishsource score over a certain threshold
-2	Feed is traceable to a feed manufacturer, however there are no policies in place to assure its responsible sourcing.	
-3	Feed is untraceable. There is no information available about the source of the marine proteins and oils, therefore the exclusion of marine proteins and oils from overexploited and/or IUU fisheries cannot be assured.	

1d. What is the overall Fish-in Fish-out ratio calculated as Feed Fish Dependency Ratio (FFDR*) for the unit of assessment?

Score	Answer Options	Examples and Answer Descriptors
2	The species has a FFDR of less than 0.5	* FFDR = Feed Fish Dependency Ratio - the quantity of wild fish **used per quantity of cultured fish produced. This measure can be calculated for fishmeal or fish oil whichever component creates the largest burden of wild fish in feed. ** Wild fish : includes both meal and oil produced from wild fish, but not include by-products from processing (trimmings).
1	The species has a FFDR of 1 or less	Deduct ~33% from the Fishmeal and/or Fish oil values, unless it states by-product percentages in the literature.
-1	The species has a FFDR between 1.1 and 2	FFDR meal = (% fishmeal in feed)(eFCR)22.2(% fishmeal in feed)(eFCR)22.2
-2	The species has a FFDR between 2.1 and 3	FFDR oil

-3	The species has a FFDR greater than 3.1	$=(\% \text{ fish oil in feed})(\text{eFCR})^5=(\% \text{ fish oil in feed})(\text{eFCR})^5$ <p>The eFCR value is species specific</p>
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1e. Are novel/alternative feed ingredients* included in the diets of the UoC? *Ingredients include: macro- and microalgal derivatives, insect protein, bacteria/fermentation proteins		
Score	Answer Options	Examples and Answer Descriptors
1	Yes, responsibly sourced/produced alternative ingredients are included	If alternative ingredients are permitted/encouraged in standard criteria or in feed manufacturers sourcing statements. We are looking for some commitment for responsible sourcing – e.g LCA assessment, or data gathering around carbon footprint.
0	No.	

CRITERION 2. ENVIRONMENTAL IMPACTS AND INTERACTIONS

2.1 RATIONALE

The construction and operation of aquaculture facilities can have an adverse impact on the surrounding environment; this can include sensitive habitat destruction² or disturbance and/or impacts on other species. In some production systems in certain areas it can also include degradation or depletion of freshwater supplies by extraction or salinisation.

2.2 CHEMICALS AND THERAPEUTANTS

² Ilman, Muhammad & Tricahyo Wibisono, Iwan & Suryadiputra, Nyoman. (2011). State of the Art Information on Mangrove Ecosystems in Indonesia.. 10.13140/RG.2.1.3967.9120.

The unregulated or misuse of chemicals and/or therapeutants in some areas³, combined with water pollution from nutrients and treatments and benthic impacts from faeces and uneaten feed⁴ is a key concern within global aquaculture production for many species. It is essential that these impacts are understood, monitored, managed and reduced as far as possible.

2.3. JUVENILES AND COMPANION SPECIES

Some forms of aquaculture, sometimes known as ranching but is more accurately described as fattening, rely upon wild stock for the provision of juveniles for on-growing in cages/tanks until they reach harvest size. This is opposed to true aquaculture that relies on hatchery reared eggs and fry. By its nature ranching/fattening does not take the pressure off wild species as there remains an element of fisheries in the process.

Companion species refers to both the use and reliance on other fish to assist with production, primarily cleaner fish species such as wrasse and lumpfish, and species that are produced alongside the primary species in a multi-trophic aquaculture system. Whilst the salmon farming industry is transitioning to farmed cleaner fish as a biological form of control of sea lice, there is still a reliance on wild caught species. This is a concern due to the lack of stock data and fisheries management measures to ensure the sustainable exploitation of these species⁵.

The reliance on wild caught stocks for the provision of juveniles or companion species like cleaner fish is of concern if coming from stocks that are over-exploited or fisheries that damage other species and habitats. Where stocks are heavily overfished or depleted e.g. European eel (*Anguilla anguilla*)⁶ and species of Bluefin tuna; or the fishing method causes significant damage to other species or habitats (e.g. Illegal, bottom towed gear in seagrass, reefs or MPAs, dynamite fishing), a critical fail is triggered and the farmed species which relies on these fisheries is assigned a default red rating.

2.4 DISEASE AND PARASITES

The risk of disease and parasite transfer can be a problem in a number of systems for a number of species. This risk can be minimized by effective management and mitigation measures however in some cases there is little or no information available to ascertain the level or extent of the risk. In some areas widespread disease outbreaks have occurred⁷.

3 Rico, A. , Satapornvanit, K. , Haque, M. M., Min, J. , Nguyen, P. T., Telfer, T. C. and van den Brink, P. J. (2012), Use of chemicals and biological products in Asian aquaculture and their potential environmental risks: a critical review. *Reviews in Aquaculture*, 4: 75-93. doi:[10.1111/j.1753-5131.2012.01062.x](https://doi.org/10.1111/j.1753-5131.2012.01062.x)

4 Handy, R.D. & Poxton, M.G. 1993. Nitrogen pollution in mariculture: toxicity and excretion of nitrogenous compounds by marine fish. *Rev Fish Biol Fisheries* 3: 205. <https://doi.org/10.1007/BF00043929>

5 Marine Conservation Society. 2018. Use of cleaner fish in aquaculture.

https://www.mcsuk.org/media/seafood/Cleaner_Fish_Position_Paper.pdf. Accessed 15/02/2018

6 Marine Conservation Society, 2018. Good Fish Guide: European eel. Available at

<https://www.mcsuk.org/goodfishguide/fish/150>. Accessed 15/02/2018

7 WORLD BANK REPORT NUMBER 88257-GLB. 2014. REDUCING DISEASE RISK IN AQUACULTURE.

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2.5 ESCAPES

Escapes from production sites are not only a financial loss for the farmer but can also have an adverse effect on the surrounding ecosystem, particularly in the case where the cultured species may be non-native to the area or can interbreed with wild species⁸. Escapes can be prevented by either the type of production system in place or by management measures such as barrier use, however in some cases escapes can be significant in both number and impact.

2.6 PREDATOR CONTROL

MCS would like to see all aquaculture facilities relying solely on non-lethal predator control measures. There are a number of non-lethal management measures available to deter predators which MCS advocates the use of. Where lethal control is used it is a particular concern when used against species that are protected or listed as threatened or endangered.

AIMS

Aquaculture facilities and operations can have a number of damaging or unwanted ecological effects to the surrounding environment, habitats and local species. It is essential that these impacts are well understood, monitored and mitigated to keep environmental impacts within acceptable levels and to demonstrate best management practices and responsible environmental stewardship. In particular, MCS would like to see aquaculture facilities that:

- In regions with limited freshwater supplies do not cause depletion or degradation through salinisation.
- Avoid locating in areas of high conservation status or ecological sensitivity.
- Avoid chemical usage or to use them in enclosed systems without waste discharge.
- Encourage the development and adoption of aquaculture systems that do not discharge directly into the surrounding open water environment, or for those that do to ensure that the discharge is known and managed so as not to cause negative impacts on habitats or species.
- Undertake the farming of species that do not have a parasite burden OR the use of systems that prevent parasite transfer outside of the farming system.
- Proactively maintain or improve the health status of cultured fish and minimise the risk of disease transmission to surrounding ecosystems.
- Use systems that prevent escapes and promote best management practices in those systems where escapes are a possibility.
- Do not lethally control or adversely disturb local wildlife

⁸ Svåsand T., Crosetti D., García-Vázquez E., Verspoor E. (eds), 2007. Genetic impact of aquaculture activities on native populations. Genimpact final scientific report (EU contract n. RICA-CT-2005-022802). 176 p. <http://genimpact.imr.no/>

2a. Do the production systems for this species in this region deplete freshwater supplies and/or degrade freshwater bodies by salinisation*?

* Degradation of freshwater in this question does not refer to any kind of organic pollution or chemical contamination, both of which are addressed in separate questions.

Score	Answer Options	Examples and Answer Descriptors
1	No	*Not applicable = Open or closed seawater systems, re-circulating freshwater system, plentiful freshwater supply and no salinisation occurring.
	Not applicable*	
0	Depletion/degradation is possible but is mitigated by management/certification standards criteria	
-1	Depletion of supplies and/or degradation of freshwater bodies (surface and groundwater) by salinisation occurs OR is data deficient	

2b. Does the production system for this species in this country/region require habitat alteration that impacts ecosystem functionality?

Score	Answer Options	Examples and Answer Descriptors
0	No	Ecological sensitivity*: Low: Land less susceptible to degradation, e.g. formerly used for agriculture or previously developed Moderate: Coastal & near-shore waters; rocky intertidal or subtidal zones; river or stream shorelines
	Alteration is small-scale OR alteration occurs in areas of low ecological sensitivity	
-1	Alterations are in areas of moderate ecological sensitivity	
	Alterations are in areas of historical degradation** with	

	verifiable restoration*** occurring	High: Coastal wetlands; mangroves; coral reefs; rainforest; any areas containing threatened or endangered species ** Historical degradation = occurring 15 years and over *** Verifiable restoration = An auditable criteria (a "must" not a recommendation) in certification standards or occurring at a regional scale with documented evidence
-2	Alterations are in areas of high ecological sensitivity with ongoing or recent habitat loss and there is no reforestation program in place	
	Data is deficient	
-3	Yes high value/sensitive habitats are impacted with high, irreversible consequence	

2c. Does the unit of assessment rely on chemical* usage, if so are there associated risks and impacts on the environment?		
* Chemicals include antibiotics, chemotherapeutants, pesticides, fungicides, antifoulants		
SCORE	ANSWER OPTIONS	EXAMPLES AND ANSWER DESCRIPTORS
1	No chemical usage	The production system is closed and does not discharge active chemicals or by-products (e.g. antibiotic resistant bacteria), or; The method of treatment does not allow active chemicals or byproducts to be discharged Data show that chemical treatments are used on average less than once per production cycle or once per year for longer production cycles, or;
	No environmental impact	The production system does not discharge water over multiple production cycles, or; Evidence of no impacts on non-target organisms
		**Clear regulations that include all chemicals used in production, which set limits for their use and those limits are not exceeded by the of producers in the unit of assessment

0	<p>Yes but the environmental impact of chemical use is known and effectively** regulated and or mitigated by independent certification standard criteria</p>	<p>Specific data may be limited, but the species or production systems have a demonstrably low need for chemical use, or;</p> <p>Evidence of only minor impacts on non-target species within the allowable zone of effect (i.e. no population-level impacts), or;</p> <p>The production system has very infrequent or limited discharge of water (e.g., once per production cycle or < 1% per day).</p> <p>Occasional, temporary or minor evidence of impacts to non-target organisms beyond an allowable zone of effect, or;</p> <p>Some evidence or concern of resistance to chemical treatments, or;</p> <p>Regulations or management measures with demonstrated effective enforcement are in place that limit the frequency of use and/or total use of chemicals.</p>
-1	<p>Yes, but the use of chemicals is within an ineffective*** regulatory or management framework</p>	<p>***Despite regulations specifying limits and monitoring chemicals used, there is evidence of limits being exceeded or there is evidence of poor enforcement</p> <p>Chemicals are known to be used on multiple occasions each production cycle and the treatment method allows their release into the environment, or;</p> <p>Chemical use (type and/or volume) is unknown but the production viability is considered to be dependent on chemical intervention, and the treatment method allows their release into the environment, or;</p> <p>Regulatory limits on chemical type, frequency and/or dose exist with unknown enforcement effectiveness or;</p> <p>Confirmed cases of resistance to chemical treatments, or;</p> <p>Chemicals highly important to human health are being used in significant or unknown quantities.</p>
	<p>Yes, there are no clear regulations for the use of chemicals</p>	<p>Illegal chemicals (as defined by the country of production) are used beyond exceptional cases or;</p> <p>Chemicals critically important to human health are being used in significant or unknown quantities, or;</p>

-2	Chemical use is unknown due to data deficiency	Negative impacts of chemical use seen on non-target organisms beyond an allowable zone of effect. Evidence of developed clinical resistance to chemicals (e.g. loss of efficacy of treatments) that are highly important or critically important to human health, or; Illegal activities with demonstrable negative environmental impacts.
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2d. Does the unit of assessment discharge* directly into the aquatic system, if so does this cause a negative impact?

* Discharge: Includes faeces, pseudofaeces, uneaten food, effluent, sludge.

Score	Answer Options	Examples and Answer Descriptors
1	No discharge	Zero input systems; Zero exchange systems; Recirculating systems; IMTA system
	Little or no negative impact	
0	Measurable negative impact within regulation and/or certification standard boundaries	E.g. defined allowable zone of effect (AZE) or within regulatory limit for effluent nutrient levels Ponds with one discharge per production cycle; extensive systems; OR ponds with frequent water exchange; intensive systems; pen net pens; flow through tanks and raceways that are operating within regulations/independent certification criteria and demonstrating full compliance
-1	Yes, but discharge occurs within an ineffective regulatory or management framework	Ponds with frequent water exchange; intensive systems; pen net pens; flow through tanks and raceways that are operating within ineffective/absent regulations and/or independent certification criteria
-2	There are no clear regulations for the limiting and monitoring of discharge	All systems that operate within regions with no regulation pertaining to discharge and water quality AND /OR where negative effects caused by illegal and unnecessary discharge are known
	Data deficient	

2e. What is the main source of juveniles or companion species for the unit of assessment?

Score	Answer Options	Examples and Answer Descriptors
1	Hatchery based	
0	Naturally settling juveniles	
	Hatchery-based juvenile or companion species production using wild caught broodstock from healthy, not overexploited wild stocks	
-1	Juveniles or companion species are taken from healthy, not overexploited wild stocks	
-2	Juveniles or companion species are caught by methods destructive* to the environment	* Destructive: Illegal or use of bottom towed gear in sensitive habitat (e.g. sea grass, MPAs, maerl beds & other reefs), explosives or chemicals for fishing.
	Juveniles or companion dependent species are caught from a stock[s] which is considered at risk (e.g. Biomass below Bmsy or mortality above Fmsy or other proxies or reference points with similar intent)	
Critical Fail	Juveniles source are heavily over-fished and the species is of listed conservation concern**	**Refer to table below (e.g. European eel)

TABLE 3 SUMMARY OF DEFAULT WILD FISHERY RATINGS

Criterion	When ...	Default rating
<p>Stock or species status</p>	<ul style="list-style-type: none"> • ICES or equivalent scientific advice is for zero catch or no direct i.e. targeted fishery and this advice is not followed • Biomass (B) is at or below B_{lim} (see Glossary) and no precautionary Recovery Plan is in place for the stock • a species is listed as Endangered or Critically Endangered by IUCN or equivalent for the sea area e.g. FAO 27 North East Atlantic in which the fishery is taking place, and the assessment report is still considered relevant (i.e. current and best assessment of species status available) • with respect to Low Trophic Level (LTL) species if there is evidence that the status of it is significantly reducing the state of other species (through links in the food chain) 	<p>5</p>
<p>Management</p>	<ul style="list-style-type: none"> • there is no appropriate or relevant management system or regulatory framework in place including • no measures to address critical issues e.g. intrinsic and widespread IUU fishing, for example 	<p>5</p>
<p>Capture method and ecological effects</p>	<ul style="list-style-type: none"> • the fishing method is: <ul style="list-style-type: none"> • causing substantial or long-lasting damage e.g. dynamite fishing, high seas drift netting, unmanaged deep-sea trawling • damaging protected features of MPAs • illegal • bottom trawling below 600m (deep sea fishing) without robust regulation in place 	<p>5</p>

2F. Is there a risk of parasitic* transfer to adjacent wild species?

***multicellular organisms i.e. crustaceans (e.g. sea lice) and helminths (e.g. flatworms)**

Score	Answer Options	Examples and Answer Descriptors
1	No risk of parasitic transfer**	**Either no parasites or no possibility of reaching wild fish
0	There is a potential problem, but the impact on wild species is limited by effective management and/or 100% farmed cleaner fish	There is evidence that sea lice numbers are on a downward trend on farmed fish and /or a zonal approach indicates a low risk (green) area
-1	Unknown status of parasitic transfer and unknown environmental impact***	***Poor data collection and transparency
-2	Yes, there is a known problem and/or risk and impact on a wild population (including cleaner fish) is evident	

2g. Is the species in this assessment subject to pathogenic* disease outbreaks that threaten the viability of the whole country/region?

***unicellular organisms i.e. bacteria (e.g. Motile Aeromonad Septicemia (M. A. S.)), viruses (e.g. Infectious Salmon Anemia (I.S.A.)), fungi, myxosporeans (emaciation disease in Sea Bream) or pathogens specific to the Unit of Assessment.**

Score	Answer Options	Examples and Answer Descriptors
1	No, aquaculture activity occurs where pathogenic disease outbreaks are not observed/recorded in wild species.	Data indicates that there is either no transmission of pathogens from farmed to wild species Data shows that wild species are not affected by pathogen transfer Disease transmission may occur but data shows that the disease level is not amplified above background levels
	Not applicable due to completely closed system.	Disease transmission may occur but do not cause physiological impacts to wild species

0	Disease outbreaks can/do occur but do not threaten regional level operations	Pathogens effect wild species but do not result in mortality Pathogens effect wild species resulting in mortality but not a population level
	-1	Yes, pathogenic disease outbreaks occur that threaten the viability of the whole region
Unknown due to data deficiency		Disease transmission occurs and effects population-level species listed on any conservation list as vulnerable, threatened, endangered (IUCN red list, OSPAR etc.)

2h. is there a risk of escapes or introductions of exotic species from this type of production, and if so, would escape cause negative ecological effects?

Score	Answer Options	Examples and Answer Descriptors
1	There is no risk of escape	No connection to natural water bodies Tank based recirculation systems Static ponds with no water discharge and no flood risk
	Not applicable to naturally settling spat	Independent monitoring data shows that escapees are not present in the wild.
0	There is a potential escape risk but with limited environmental impact	There is evidence of escapes, but no alteration of wild species and their habitats Any system that uses Best Management Practices to prevent escapes which can be verified by audit AND independent data indicated escape numbers are low. Flow through systems Ponds with a moderate risk of vulnerability to flooding events Ponds with moderate exchange (e.g. 3–10% per day) or that drain externally at harvest Open systems with demonstrably effective Best Management Practices for design, construction, and management of escape prevention
-1	Unknown escape risk	Open systems with Best Management Practices for design, construction, and management of escape prevention are in place but their efficacy cannot be demonstrated.
	Unknown environmental impact*	*poor data collection and transparency Production systems vulnerable to large escape events or frequent trickle losses Monitoring data indicates escapees are frequently detected in the wild Ponds with high exchange > 10% per day
		Open systems (e.g., net pens, cages, ropes) vulnerable to escape, without effective Best Management Practices for design, construction and management of escape prevention

-2	There is an escape risk with evidence of negative ecological effects	<p>Large escapes or frequent trickle losses have occurred in the last 10 years, and no corrective action has been taken, or corrective actions taken have not been adequate</p> <p>Ponds in flood prone areas</p> <p>Monitoring data indicates frequent occurrence of large numbers of escapees in the wild</p> <p>Negative ecological effects include competition for resources; displacement of wild species eggs/larvae; interbreeding and genetic dilution.</p>
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zi. In general, does this type of production have direct negative impacts on local predatory species in the region?		
Score	Answer Options	Examples and Answer Descriptors
1	No	
0	Potential impacts, not including lethal control	Use of ADD's that may disturb species such as cetaceans.
-1	Yes, predatory species are lethally controlled	
	Unknown due to data deficiency	
-2	Yes, predatory species that are listed as threatened, endangered or protected on any domestic or protected on any domestic or international list are lethally controlled	

CRITERION 3. FISH WELFARE

3.1 RATIONALE

Fish welfare is both a key concern for many consumers and a key indicator of good management practices within the culture system.

Scientific evidence from behavioural, physiological and anatomical studies shows that it is highly likely that fish feel pain. Fish also have a similar stress response system to mammals. It is essential that staff managing farmed fish are aware of the importance of welfare as an integral part of production.⁹

The Farm Animal Welfare Council define the “Five Freedoms” to promote good welfare and prevent suffering¹⁰:

- Freedom from hunger and thirst by ready access to fresh water and a diet to maintain full health and vigour.
- Freedom from discomfort by providing an appropriate environment including shelter and a comfortable resting area.
- Freedom from pain, injury or disease by prevention or rapid diagnosis and treatment.
- Freedom to express normal behavior by providing sufficient space, proper facilities and company of the animal’s own kind.
- Freedom from fear and distress by ensuring conditions and care which avoid mental suffering.

AIM

To encourage and support welfare and humane slaughter standards for aquaculture species that respect the Five Freedoms outlined above.

9 RSPCA Welfare Standards for farmed Atlantic salmon. February 2018. Available online at: <file:///C:/Users/Dawn%20Purchase/Downloads/Salmon%20standards%202018PT.pdf>. Accessed 06/04/2018.

10 Farm Animal Welfare Council. 2009. Farm Animal Welfare in Great Britain: Past, Present and Future. Available online at:

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/319292/Farm_Animal_Welfare_in_Great_Britain_-_Past_Present_and_Future.pdf. Accessed 06/04/2018.

3a. Are there practices in place to ensure animal welfare and humane slaughter for the unit of assessment?

Score	Answer Options	Examples and Answer Descriptors
1	Yes, there are practices to ensure animal welfare* and humane slaughter**	*Compromised animal welfare leads to physical damage, aggression and pre-harvest mortalities. Culture conditions that lead to physical deformities can compromise animal welfare and should be included in this question. This question only refers to the culture species. **Humane slaughter RSPCA definition: "An animal must be either killed instantly or rendered insensible to pain until death supervenes" (generally only applicable to electrical or mechanical stunning followed by bleeding)
	Not applicable***	*** Shellfish species
0	Either provisions for animal welfare or humane slaughter are provided but not both	Provision included in regulations in the country or region assessment and/or in certification criteria
-1	No	
	Unknown due to data deficiency	

CRITERION 4. REGULATION AND MANAGEMENT

4.1 RATIONALE

Alongside the impacts of individual fish farms there is a need to understand both the cumulative impacts and the cumulative carrying capacity¹¹ (not applicable to land based systems) of aquaculture operations in a given area, be it loch, lake, or river basin. The impacts and carrying capacity can be determined by the use of strategic environmental assessments and spatial planning.

Robust regulations can ensure the establishment, structure and function of aquaculture facilities does not adversely affect sensitive habitats, species, water quality or other marine users. It is therefore imperative that a robust regulatory framework is in place in the region under assessment.

Robust regulations are meaningless unless there is effective implementation, with sufficient monitoring in place. If for instance there was a regulation to prevent the introduction of non-native species yet it was recorded that non-natives were prevalent in an area, this would indicate the regulation is not effective in achieving its aims.

Independent, 3rd party audited production standards ensure that many, if not all the issues of environmental concern, including criteria used in this assessment are addressed. Consumer facing eco-label schemes have the added advantage of directing consumers to the most responsibly produced farmed seafood, which also helps drive demand for these products. Schemes which also have robust chain of custody traceability requirements, also have the added bonus of providing confidence to consumers and businesses, that specific products have been produced to the standard of the ecolabel on pack.

AIMS

Robust and effective regulation, along with good farming practices is the foundation of responsible production and good environmental performance. MCS aims to support and encourage production systems in regions that operate to robust regulations and /or certification criteria that address key issues of environmental concern. These include:

- The adoption of a regional level planning system with effective enforcement that includes aquaculture operations and their cumulative effects.
- Regulations/criteria in place are enforced and effective in reducing/minimizing negative impacts.

11 Á Borja, JG Rodríguez, K Black, A Bodoy, C Emblow. 2009. Assessing the suitability of a range of benthic indices in the evaluation of environmental impact of fin and shellfish aquaculture located in sites across Europe. *Aquaculture*. Volume 293, Issues 3–4, 16 August 2009, Pages 231-240

- The adoption of 3rd party certification standards or progress towards certification. 3rd party certification ensures transparent, audited and traceable product.

4a. Is aquaculture production in this UoA operating within some form of Area Based Management Framework or zonal approach?		
Score	Answer Options	Examples and Answer Descriptors
1	Yes there is an area based management framework or zonal approach in place.	This is evidenced by certification standard criteria, Country/Regional level regulations, Codes of Practice. ^{12 13 14}
	Not applicable due to the production system being used*.	*This includes land based production such as RAS, flow through systems, ponds and raceways.
0	No, or no evidence.	

¹² "It is a legal requirement for farmers to be party to a Farm Management Statement or Agreement. The requirement set out in law is based upon the provisions of this CoGP." Taken from Code of Good Practice for Scottish Aquaculture. Chapter 4. Seawater lochs. Available at: <https://www.salmonscotland.co.uk/code-of-good-practice>

¹³ Fishsource. Aquaculture Profiles. Salmon, Chile. Available online : https://www.fishsource.org/ama_page?id=37

4b. Is there a regulatory framework OR independent certification criteria for this species in the region that includes/addresses the following issues:

Farm Level Environmental Impact Assessment (EIA)

Identification and protection of valuable habitats & species

Use of land and water resources

Use of chemicals including licensing

Discharges including effluents and their impacts

Bio-security & disease management

Species introduction

SCORE	ANSWER OPTIONS	EXAMPLES AND ANSWER DESCRIPTORS
2	There are regulations or standard criteria for all	List regulations or standard criteria which relate to each of the issues above in the description box of assessment form.
1	There are regulations or standard criteria for >5	
0	There are regulations or standard criteria for 3-5	
-1	There are regulations or standard criteria for <3	
	There is no information available	
-2	There are no regulations or standard criteria	

4c. Is the regulatory framework or independent certification criteria for the species in this region effective in minimising negative impacts?

Score	Answer Options	Examples and Answer Descriptors
1	Regulations or standard criteria are fully* effective	*None of the assessment questions in section 2 or in 4b have been scored negatively as a result of poor/ineffective regulations
0	There is evidence indicating regulations or standard criteria are only partially** effective	**One or more of the assessment questions in Section 2 or 4b have been negatively scored due to poor regulation
-1	There is insufficient information to assess effectiveness***	***There may be regulations but there is no data to ascertain effectiveness, there is no public data/auditing reports
	There is evidence indicating regulations or standard criteria are ineffective****	****There are records of regulations or standard criteria being broken

4d. Are producers of this species in the region producing to independently on-site audited, 3rd party certification standards?

Score	Answer Options	Examples and Answer Descriptors
2	Producers in this unit of assessment farm to an independent audited standard*	This does not need to be a consumer facing label, however it does need to be either a standards that are ISEAL community members ¹⁵ , organic or recognized by GSSI ¹⁶
1	Producers in this unit of assessment are working towards improvement via a credible Aquaculture Improvement Project (AIP)* or Fisheries Improvement Project (FIP) (for the feed component) which is operational and demonstrating improvements including those schemes that lead to certification.	* See description below
0	No certification scheme or AIP/FIP is available for the unit of assessment	
-1	There are certification schemes or AIP's/FIP's available for the unit of assessment but no efforts are being made to apply.	This score is for uncertified species.

¹⁵ ISEAL Community Members. Available online: <https://www.isealalliance.org/iseal-community-members>

¹⁶ GSSI. Recognised Certification. Available online at: <https://www.ourgssi.org/gssi-recognized-certification/>

7. DEFINITION OF AQUACULTURE AND FISHERIES IMPROVEMENT PROJECTS

AQUACULTURE IMPROVEMENT PROJECTS (AIP'S)

According to the Sustainable Fisheries Partnership: *“An Aquaculture Improvement Project (AIP) is an alliance of producers, processors, suppliers, and buyers working together to address sustainability issues in a fish- (or shrimp-) farming zone. The zone may be a common water input/discharge source (canal, river, aquifer, or reservoir); a government-designated administrative division such as a development plan area or “park”; and/or a geographic feature such as an island, valley, or coastal area.*

AIPs are designed to bring all stakeholders together to recognize their responsibilities and take actions to improve the environmental and social quality of the production zone. Key actions include understanding and implementing carrying capacity models, agreeing on specific control measures to deal with disease outbreaks, and developing market incentives for improvements.”¹⁷

There are a range of ways to improve aquaculture facilities towards sustainability and MCS is very supportive of AIPs, particularly for high risk species, such as those that are red or amber rated by MCS.

For an AIP to be considered as ‘credible’ the following general criteria should apply:

- An independent observer/facilitator (e.g. NGO)
- Relevant stakeholder participation
- Identification and addressing of key environmental issues in production
- Adherence to SMART objectives
- Public accountability

In addition to the above, for an AIP to be considered by MCS in its ratings assessments, it should be at a stage where it is making progress according to the indicators and timelines in its work plan and achieving improvements so as to address the key issues of environmental concern.

FISHERIES IMPROVEMENT PROJECTS (FIP)

According to the US Conservation Alliance for Sustainable Seafood (CASS) a ‘fishery improvement project is a multi-stakeholder effort to improve a fishery. These projects are unique because they utilise the power of the private sector to incentivise positive changes toward sustainability in the fishery. Participants may vary depending on the nature of the fishery and the improvement project, and may include stakeholders such as producers, non-governmental organisations, fishery managers, government and members of the fishery’s supply chain’.¹⁸ The Sustainable Fisheries

¹⁷ Aquaculture Improvement Projects. Sustainable Fisheries Partnership. Available at: <https://www.sustainablefish.org/Programs/Aquaculture/Aquaculture-Improvement-Projects>. Accessed 30/04/2018

¹⁸ CASS. FIP Guidelines, available at:

<http://cmsdevelopment.sustainablefish.org.s3.amazonaws.com/2013/08/01/Conservation%20Alliance%20FIP%20Guidelines-b7586ofc.pdf> [Accessed 1/09/16]

Partnership (SFP) note that whilst each FIP is unique, the common thread is that the supply chain plays a critical role in helping a fishery in the journey towards sustainability.¹⁹

There are a range of ways to improve fisheries towards sustainability and MCS is very supportive of FIPs, particularly for high risk fisheries, such as those that are red or amber rated by MCS.

For a FIP to be considered as 'credible' the following general criteria should apply:

- An independent observer/facilitator (e.g. NGO)
- Relevant stakeholder participation
- Identification and addressing of key environmental issues in fishery
- Adherence to SMART objectives
- Public accountability

In addition to the above, for a FIP to be considered by MCS in its ratings assessments, it should be at a stage where it is making progress according to the indicators and timelines in its work plan and achieving improvements in the way the fishery is managed or operated so as to address the key issues of environmental concern. This would correspond to **Stage 4** or more of the Conservation Alliance for Seafood Solutions (CASS) Fisheries Improvement Guidelines¹⁰ or equivalent.

In cases where a FIP has been publicly launched and a programme of work agreed, but is not yet at the stage of achieving improvements in management or practices (ie. CASS **Stage 3**), MCS may recognise the initiative through an alternative sourcing recommendation provided the FIP remains within its agreed schedule.

RECOGNITION OF AIP'S AND FIP'S

In cases where an Improvement Project (IP) has been publicly launched and a programme of work agreed, but is not yet at the stage of achieving improvements in management or practices (ie. CASS **Stage 3** for FIP's), MCS may recognise the initiative through an alternative sourcing recommendation provided the IP remains within its agreed schedule.

This will be depicted (see Figure 2) by the addition of a left facing arrow over the normal 5 rating, indicating that although participation in the IP would not be sufficient to influence the rating assessment, it would serve to recognise that credible improvement work is underway. In such instances, MCS would not advise against sourcing species from the production area or fishery, thus providing, we hope, an incentive for businesses to support credible improvement projects.



FIGURE 2 EXAMPLE OF RATING GRAPHIC FOR RED RATED SPECIES IN A RECOGNISED IMPROVEMENT PROJECT

¹⁹ SFP. Seafood industry guide to FIPs, available at: <http://cmsdevelopment.sustainablefish.org.s3.amazonaws.com/2014/04/28/SFP%20FIPS%20Guide%202014-46b3eb10.pdf> [Accessed 5/05/17].

8. SOURCES OF INFORMATION

MCS relies upon a number of sources of scientific information, organizational information including regulations and production standards to inform our aquaculture assessments. These resources include but are not limited to the following:

- Food and Agriculture Organisation of the United Nations (FAO)
- Europa – website of the European Union
- Standard holders and Certification bodies, such as Aquaculture Stewardship Council (ASC), Global Aquaculture Alliance Best Aquaculture Practices (GAA BAP 2*, 3*,4*) and GlobalGap
- Marine Scotland
- Environment Agency
- Centre for Environment Fisheries and Aquaculture Science (CEFAS)
- Scottish Environment Protection Agency (SEPA)
- Scientific journals
- Industry contacts

9. APPENDICES

APPENDIX 1 EXTERNAL REVIEW PROCESS

Following the release of the latest scientific advice and as part of MCS scheduled ratings updates in the Summer and Winter each year (see Appendix II), MCS consults externally on proposed changes to seafood ratings.

Interested parties with technical insight, relevant industry or scientific expertise or those with information that could contribute to the comprehensiveness and quality of the assessments, are particularly invited to input.

To receive notifications about ratings updates and consultations, please email us at ratings@mcsuk.org and request to be added to our interested parties email distribution list.

Details of ratings consultations will also be made available online at:

<https://www.mcsuk.org/ocean-emergency/sustainable-seafood/about-the-good-fish-guide/how-our-good-fish-guide-ratings-work/ratings-consultations/>

APPENDIX II GOOD FISH GUIDE UPDATE SCHEDULE

Jan	<i>Ratings research</i>
Feb	Winter Consultation
Mar	<i>GFG team reviews consultation input</i>
Apr	Launch
May	
Jun	<i>Ratings research</i>
Jul	
Aug	Summer Consultation
Sep	<i>GFG team reviews consultation input</i>
Oct	Launch
Nov	<i>Ratings research</i>
Dec	

APPENDIX III AQUACULTURE CERTIFICATION PROGRAMMES RECOGNISED BY MCS

Aquaculture Stewardship Council (ASC)
Global Aquaculture Alliance Best Aquaculture Practices (GAA BAP) 2* (Farm) 3* (Farm+ Hatchery or Feed Mill) 4* (Farm+ Hatchery+ Feed Mill). Please note 1* refers only to the processing plant and as such is not recognised by MCS
GlobalGap
ORGANIC AQUACULTURE CERTIFICATION PROGRAMMES RECOGNISED BY MCS - WITH A CONSUMER FACING LOGO, STANDARD REVIEW PROCESS AND INDEPENDANT AUDITING
Soil Association Organic
Naturland Organic
Organic Food Federation
Irish organic
EU organic standard
FEED INGREDIENT STANDARDS RECOGNISED BY MCS
Marine Stewardship Council (MSC)
MarinTrust
Proterra
Roundtable on Responsible Soy
RSPO

APPENDIX IV: AQUACULTURE PRODUCTION SYSTEMS

Salmon, trout, marine fish, flatfish in cages
Salmon, trout, marine fish, flatfish in tanks onshore without recirculation
Salmon, trout, marine fish, flatfish in tanks onshore with recirculation
Salmonids in ponds without recirculation
Salmonids in ponds with recirculation
Freshwater fish in ponds without recirculation
Freshwater fish in ponds with recirculation
Freshwater fish in cages
Freshwater fish in tanks without recirculation
Freshwater fish in tanks with recirculation
Shrimps in ponds without recirculation
Shrimps in ponds with recirculation
Shrimps in tanks without recirculation
Shrimps in tanks with recirculation
Shellfish in tanks without recirculation
Shellfish in tanks with recirculation
Shellfish on ropes
Shellfish in baskets
Shellfish on sticks
Shellfish ranched