Development of an Evaluation Method for Local Rating of Sustainable Seafood

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ABSTRACT: This research helps local consumers choose seafood caught in a way that supports healthy ocean and human health for the present and future generations. So this research develops an evaluation items in three ways: Sustainable fisheries, safety and regional sustainability. Furthermore, the rating system has three levels. We consider the local rating system that recommends local production and consumption of seafood for sustainable fisheries as a model case. There are 19 species that could be evaluated this time, but we will improve
so that we can evaluate more species in the future.

INTRODUCTION

In recent years, certification and rating evaluation of seafood for sustainability, such as Marine Stewardship Council (MSC) certification and Seafood Watch rating system by Monterey Bay Aquarium, are widely used in the world for supply increase and resource reduction (FAO, 2018).

In Japan, Marine Eco-Label Japan Council (MEL) issued in August 2012 and WWF Japan's Sushi Guide are exists as a certification system and rating system, respectively. But there are criticisms about them. The objectivity, transparency and update frequency of these evaluation systems are not satisfactory compared to the recommended list in Europe and the United States. In addition, the Ocean Health Index (OHI) advocated by Conservation International pointed out that consideration of radioactive substances after Fukushima Nuclear Power Plant accident was insufficient.

Aquamarine Fukushima is developing a unique rating system called Happy Oceans. The restaurant uses its evaluation for several aquariums. The educational effect can be expected by providing aquarium centered on topping on sushi rice with stable resource amount.

In the case of Fukushima, what kind of seafood is recommended for sustainable fisheries and consumer sustainability? In this research, we propose a new rating system to improve Happy Oceans by adding scientific basis and considering regional revitalization.

OBJECTIVE

This research develops an evaluation items in three ways: Sustainable fisheries, safety and regional sustainability. Furthermore, the rating system has three levels (Table1).

We consider the local rating system that recommends local production and consumption of seafood for sustainable fisheries as a model case.

Table 1. Three levels of the evaluation system.

Level	Mean
Green	Best Choice
Yellow	Good Alternative
Red	Avoid

METHODS

The rating list should be updated once a year. Therefore, we developed methods for everyone as simple to understand and easy to obtain data for evaluation.

The selection of the evaluated fish species has been done by regional sustainability results.

1. Sustainable fisheries

From International Union for Conservation of Nature and Natural Resources (IUCN) Red List, threatened species is evaluated the population reduction rate:

Critically Endangered (CR): An observed, estimated, inferred or suspected population size reduction of ≥80% over the last 10 years or three generations, whichever is the longer, where the reduction or its causes may not have ceased OR may not be understood OR may not be reversible, based on (and specifying) any of (a) to (e) under A1.

Endangered (EN): An observed, estimated, inferred or suspected population size reduction of ≥50% over the last 10 years or three generations, whichever is the longer, where the reduction or its causes may not have ceased OR may not be understood OR may not be reversible, based on (and specifying) any of (a) to (e) under A1.

Vulnerable (VU): An observed, estimated, inferred or suspected population size reduction of ≥30% over the last 10 years or three generations, whichever is the longer, where the reduction or its causes may not have ceased OR may not be understood OR may not be reversible, based on (and specifying) any of (a) to (e) under A1.

(IUCN, 2012)

Table 2. Evaluation method of the sustainable fisheries.

Level	Evaluation method
Green	An observed, estimated, inferred or suspected population size reduction of <30% the last 10 years
Yellow	An observed, estimated, inferred or suspected population size reduction between 30% and 50% over the last 10 years
Red	An observed, estimated, inferred or suspected population size reduction of ≥50% over the last 10 years

According to the above criteria based on the population reduction rate, we developed the evaluation method (Table2). From Fisheries Agency's resource assessment, we confirmed the reduction rate of resource from fiscal year 2005 to 2015.

2. Safety

Since 2012, a radioactive cesium of the maximum limits for seafood is 100 Bq/kg.

The limits for general foods were established after considering the differences in the amount of food consumed according to sex and age groups and the impact of radioactive materials on health. The calculation is based on the annual additional radiation dose that would not exceed approximately 0.9 mSv even if 50% of the foods contained a certain level of radioactive materials and if such foods are ingested continuously (limits for radioactive materials in food). The value of "100 Bq/kg" was consequently determined based on the most conservative limit (meaning lower limits) established for males aged 13-18. Accordingly, this is considered the safe limit for people of both sexes and all age groups (Consumer Affairs Agency, 2018).

In order to investigate the contamination situation of seafood due to emission of radioactive materials from Tokyo Electric Power Company (TEPCO)'s Fukushima Daiichi Nuclear Power Plant, the Fisheries Agency investigates sampled fisheries once a week at major ports in Fukushima Prefecture and neighboring prefecture. Since April 2015, no marine fish species exceed the limit of 100 Bq/kg.

According to the above scientific knowledge of health risks, we developed the evaluation method (Table3). 500 Bq/kg is the previous limit. From March 2011 until May 2014, some marine fish species exceeded the previous limit. But now no contaminated fish has been sampled, therefore we think that health risk is low.

Table 3. Evaluation method of the safety.

Level	Evaluation method
Green	<100 Bq/kg
Yellow	100 - 500 Bq/kg
Red	>500 Bq/kg

3. Regional sustainability

We calculated the self-sufficiency rate using wholesale market annual report of Iwaki City in Fukushima Prefecture. Definition of self-sufficiency rate is below. According to the continuity of resultant value, we developed the evaluation method (Table4).

Table 4. Evaluation method of the regional sustainability.

Level	Self-sufficiency rate
Green	≥10%
Yellow	Positive but < 10%
Red	0%

Self-sufficiency rate = X/(X+Z),
X: the amount of seafood caught in Fukushima prefecture and also distributed in Fukushima prefecture.
Z: the amount of seafood caught outside Fukushima prefecture and distributed in Fukushima prefecture.

RESULTS

1. Sustainable fisheries

Table 5. Result of the sustainable fisheries.

Fish species	resource reduction rate*
Paralichthys olivaceus	-412.9
Tanakius kitaharae	-54.9
Pagrus major	5.3
Gadus chalcogrammus	20.8
Gadus macrocephalus	-174.1
Todarodes pacificus	24.7
Scomber japonicus	-166.6
Sebastolobus macrochir	-1.2
Sardinops melanostictus	-1158.7
Etrumeus teres	-141.1
Makaira nigricans	-5.4
Eopsetta grigorjewi	46.2
Cololabis saira	44.2
Chionoecetes opilio	43.4
Tetrapturus audax	31.3
Thunnus orientalis	52.8
Scomber australasicus	53.4
Trachurus japonicus	58.1
Engraulis japonicus	80.4
Octopoda Leach	NA
Chelidonichthys spinosus	NA
Salangichthys microdon	NA
Argyrosomus argentatus	NA
Lophius litulon	NA
Thunnus albacares	NA
Katsuwonus pelamis	NA
Thunnus obesus	NA
Konosirus punctatus	NA
Arctoscopus japonicus	NA
Oncorhynchus keta	NA
Seriola quinqueradiata	NA
Odontobutis obscura	NA
Lateolabrax japonicus	NA
Anguilla japonica	NA
Pandalus eous	NA
Oncorhynchus gorbuscha	NA
Clupea pallasii	NA
Sebastes baramenuke	NA

* Negative numbers mean resource increase. NA means there is no data available.

2. Safety

The contamination levels are shown in Table 6. We assumed "NA" is safe (Green) because these fish are probably caught in far offshore, but we will check other data source in the future.

Table 6. Result of the radioactive contamination level.

Fish species	Maximum Contamination level of Cs134+Cs137 during April 2017 – March 2018
Paralichthys olivaceus	15
Tanakius kitaharae	8.2
Pagrus major	6.1
Gadus chalcogrammus	undetectable
Gadus macrocephalus	0.76
Todarodes pacificus	8.1
Scomber japonicus	0.4
Sebastolobus macrochir	undetectable
Sardinops melanostictus	undetectable
Etrumeus teres	undetectable
Makaira nigricans	NA
Eopsetta grigorjewi	0.39
Cololabis saira	undetectable
Chionoecetes opilio	undetectable
Tetrapturus audax	NA
Thunnus orientalis	undetectable
Scomber australasicus	undetectable
Trachurus japonicus	0.58
Engraulis japonicus	undetectable
Octopoda Leach	13
Chelidonichthys spinosus	NA
Salangichthys microdon	NA
Argyrosomus argentatus	NA
Lophius litulon	NA
Thunnus albacares	NA
Katsuwonus pelamis	NA
Thunnus obesus	NA
Konosirus punctatus	NA
Arctoscopus japonicus	NA
Oncorhynchus keta	NA
Seriola quinqueradiata	NA
Odontobutis obscura	NA
Lateolabrax japonicus	66
Anguilla japonica	32
Pandalus eous	NA
Oncorhynchus gorbuscha	NA
Clupea pallasii	NA
Sebastes baramenuke	NA

3. Regional sustainability

The result of Sustainable fisheries is as follows (Table 7).

Table 7. Rate of the self-sufficiency (X/(X+Z)).

Fish species	Rate of the self-sufficiency (X/(X+Z))
Paralichthys olivaceus	34.9
Tanakius kitaharae	33.6
Pagrus major	13.2
Gadus chalcogrammus	6.7
Gadus macrocephalus	6.7
Todarodes pacificus	6.0
Scomber japonicus	5.9
Sebastolobus macrochir	2.7
Sardinops melanostictus	2.6
Etrumeus teres	2.6
Makaira nigricans	0
Eopsetta grigorjewi	33.6
Cololabis saira	32.6
Chionoecetes opilio	22.7
Tetrapturus audax	0
Thunnus orientalis	16.8
Scomber australasicus	5.9
Trachurus japonicus	4.4
Engraulis japonicus	2.6
Octopoda Leach	72.7
Chelidonichthys spinosus	31.1
Salangichthys microdon	22.6
Argyrosomus argentatus	21.2
Lophius litulon	19.7
Thunnus albacares	17.2
Katsuwonus pelamis	15.1
Thunnus obesus	5.8
Konosirus punctatus	4.9
Arctoscopus japonicus	2.5
Oncorhynchus keta	2.3
Seriola quinqueradiata	1.9
Odontobutis obscura	1.3
Lateolabrax japonicus	1.2
Anguilla japonica	0.7
Pandalus eous	0.6
Oncorhynchus gorbuscha	0
Clupea pallasii	0
Sebastes baramenuke	0

DISCUSSION

1. Sustainable fisheries

There are few species that can be evaluated for international species evaluated by Japanese Fisheries Research and Education Agency. We could add species whose resource assessments are not shown in Fisheries Agency.

2. Safety

We will continue to check the Fisheries Agency's investigate results on radioactive contamination of seafood.

Table 8. Result of the local rating.

Fish species	1. SF	2. S	3. RS
Paralichthys olivaceus	G😊	G😊	G😊
Tanakius kitaharae	G😊	G😊	G😊
Pagrus major	G😊	G😊	G😊
Gadus chalcogrammus	G😊	G😊	Y😐
Gadus macrocephalus	G😊	G😊	Y😐
Todarodes pacificus	G😊	G😊	Y😐
Scomber japonicus	G😊	G😊	Y😐
Sebastolobus macrochir	G😊	G😊	Y😐
Sardinops melanostictus	G😊	G😊	Y😐
Etrumeus teres	G😊	G😊	Y😐
Makaira nigricans	G😊	G😊	R☹
Eopsetta grigorjewi	Y😐	G😊	G😊
Cololabis saira	Y😐	G😊	G😊
Chionoecetes opilio	Y😐	G😊	G😊
Tetrapturus audax	Y😐	G😊	R☹
Thunnus orientalis	R☹	G😊	G😊
Scomber australasicus	R☹	G😊	Y😐
Trachurus japonicus	R☹	G😊	Y😐
Engraulis japonicus	R☹	G😊	Y😐
Octopoda Leach	NA	G😊	G😊
Chelidonichthys spinosus	NA	G😊	G😊
Salangichthys microdon	NA	G😊	G😊
Argyrosomus argentatus	NA	G😊	G😊
Lophius litulon	NA	G😊	G😊
Thunnus albacares	NA	G😊	G😊
Katsuwonus pelamis	NA	G😊	G😊
Thunnus obesus	NA	G😊	Y😐
Konosirus punctatus	NA	G😊	Y😐
Arctoscopus japonicus	NA	G😊	Y😐
Oncorhynchus keta	NA	G😊	Y😐
Seriola quinqueradiata	NA	G😊	Y😐
Odontobutis obscura	NA	G😊	Y😐
Lateolabrax japonicus	NA	G😊	Y😐
Anguilla japonica	NA	G😊	Y😐
Pandalus eous	NA	G😊	Y😐
Oncorhynchus gorbuscha	NA	G😊	R☹
Clupea pallasii	NA	G😊	R☹
Sebastes baramenuke	NA	G😊	R☹

3. Regional sustainability

We will obtain data directly from the wholesale company so increase the number of evaluation species. Also, we will consider food mileage as an evaluation method.

CONCLUSION

This local rating helps local consumers choose seafood that's fished in ways that support a healthy ocean and your health, now and for future generations. There are 19 species that could be evaluated this time, but we will improve so that we can evaluate more species in the future.

The result of sustainable fisheries, safety and regional sustainability are shown in Table 8. NA means there is no data available.

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