OCEAN OUTCOMES
Fish | Food | Livelihoods

Blue Seafood Guide Assessment Report

Bastard halibut, North Pacific stock

Dr. Jocelyn Drugan
June 2019

(Image from hatcheryinternational.com)

Introduction to the BSG Assessment Methodology

The Blue Seafood Guide (BSG) methodology is primarily based on the Rapid Assessment tool co-developed by Ocean Outcomes (O2), World Wildlife Fund US, and the Sustainable Fisheries Partnership. The tool uses Marine Stewardship Council (MSC) performance indicators, with incorporation of some concepts from the Monterey Bay Aquarium Seafood Watch (MBA SFW) Fisheries Standard. The methodology has also been adapted to account for general characteristics of the existing Japanese fisheries management system. Specifically, deficiencies in information (e.g. monitoring of other species caught in a fishery) and management components (e.g. harvest control rules) that are systemic will be mentioned in the assessment, but not necessarily considered in the BSG species selection process.

To be included in the BSG, the stock/species must not receive a red score for any of the indicators that are considered.

Summary of results

In Japan, bastard halibut are managed as four stocks: North Pacific, Setouchi (Seto Inland Sea), North-Central Japan Sea, and West Japan Sea / East China Sea. As of 2018, FRA stock assessments determined that the North Pacific stock was at a high level, the Setouchi and North-Central Japan Sea stocks were at a medium level, and the West Japan Sea / East China Sea was at a low level. In addition, an MSY-based stock assessment suggested that the stock was likely above MSY in 2015. Enhancement activities take place where halibut seedlings are artificially produced and then released into the wild. However, the wild population of North Pacific halibut does not appear dependent on artificial seedling production, which was significantly reduced following the 2011 Great Tohoku Earthquake.

Because the gear type contacts the sea bottom, habitat impacts are likely to be moderate, although fishing is thought to take place over soft and sandy bottoms that are relatively resilient. Trophic relationships involving bastard halibut are broadly understood, but ecosystem impacts of halibut fisheries do not appear to have been studied in detail. Fishing levels do not appear to be high enough to disrupt key ecosystem elements. Ecological impacts from enhancement are not explicitly monitored, and more information on artificial production practices would be useful to obtain.

Individual prefectures that fish this stock, such as Ibaraki Prefecture, have some management objectives and/or measures in place for the fishery. For example, gear specifications (e.g. minimum mesh size) and fishery closed seasons and areas are used to maintain productivity and manage fishing effort. Fishing effort on this stock was strongly affected by the 2011 Tohoku earthquake, as fishing activity declined drastically following the earthquake and has since been gradually reinstated on an experimental basis.

BSG qualification outcome

Bastard halibut (North Pacific stock) qualifies for inclusion in the BSG.

Scoring summary

Principle	Component	PI #	Performance Indicator	Scoring category
1	Outcome	1.1.1	Stock status outcome	
		1.1.2	Stock rebuilding outcome	Not considered
	Management	1.2.1	Harvest Strategy	
		1.2.2	Harvest control rules	Not considered

		1.2.3	Information and monitoring	
		1.2.4	Assessment of stock status	
2	Other species	2.2.3	Other species information	Not considered
		2.2.1	Other species outcome	Not considered
		2.2.2	Other species management	Not considered
	ETP species	2.3.3	ETP species information	Not considered
		2.3.1	ETP species outcome	Not considered
		2.3.2	ETP species management	Not considered
	Habitats	2.4.3	Habitats information	
		2.4.1	Habitats outcome	
		2.4.2	Habitats management	
	Ecosystem	2.5.3	Ecosystem information	
		2.5.1	Ecosystem outcome	
		2.5.2	Ecosystem management	
3	Governance & policy	3.1.1	Legal and customary framework	
		3.1.2	Consultation, roles and responsibilities	
		3.1.3	Long term objectives	
	Fishery specific management system	3.2.1	Fishery-specific objectives	
		3.2.2	Decision-making processes	
		3.2.3	Compliance and enforcement	
		3.2.4	Management performance evaluation	

Basic fishery information

Target species scientific name and common name	Bastard halibut (*Paralichthys olivaceus*), *hirame* (ヒラメ)
Fishery location and season	This stock is caught off the northeast coast of Honshu, Japan, from Aomori to Ibaraki prefectures (Fig. 1). Fisheries operate year-round, with highest catches of 1 year-old recruits occurring in autumn.
Gear type(s)	The main gears are small bottom trawl (小型底びき網), gillnet (刺網) and set net (定置網).
Catch quantity (weight)	According to aquaculture annual production statistics, catches for five prefectures (Aomori, Iwate, Miyagi, Fukushima, and Ibaraki) averaged 2,447 t from 2012 to 2016, with a catch volume of 2,332 t in 2016.
Management authorities	Fishery cooperative associations, prefectural governments (Aomori, Iwate, Miyagi, Fukushima, and Ibaraki), Tohoku National Fisheries Research Institute, Fisheries Agency of Japan

Figure 1. Distribution of the North Pacific stock of Japanese flounder, shown in pink. Image from http://abchan.fra.go.jp/digests2017/html/2017_57.html

Description of the fishery

In Japan, bastard halibut are managed as four stocks: North Pacific, Setouchi (Seto Inland Sea), North-Central Japan Sea, and West Japan Sea / East China Sea. Stock structure has not been determined empirically, although tagging studies suggest that there may be two spawning groups, one offshore of Aomori-Iwate, and one offshore of Miyagi-Fukushima-Ibaraki (Kurita et al. 2017). The North Pacific stock is fished by five prefectures: Aomori, Iwate, Miyagi, Fukushima, and Ibaraki. Fishing effort on this stock was strongly affected by the 2011 Tohoku earthquake, as fishing activity declined drastically following the earthquake and has since been gradually reinstated on an experimental basis.

Although fishing is technically allowed year round, some regions may set specific fishery openings and closures, e.g. by gear type. Starting in the latter half of the 1990s, a minimum size limit was implemented (30 cm total length, or 35 cm total length in some areas). Fish under the size limit have to be released (Kurita et al. 2017).

Catches of the North Pacific stock across the five prefectures appear to be split fairly evenly amongst major gear types (trawl, gillnet, and set net; see Table 1). Juveniles (seedlings) are artificially produced using wild, native adults and released to enhance natural recruitment to the fishery. Seedling production reportedly does not involve substantial augmentation of food supply, application of medicinal chemicals, or habitat modification. These enhancement activities are currently conducted on a smaller scale than they were prior to the 2011 earthquake (Table 2). An average of 4.6 million seedlings were released each year from 2006 to 2010, whereas an average of 1.2 million were released each year from 2011 to 2015. Following best environmental practice, impacts of enhancement activity on sustainability of the wild stock should be considered.

Table 1. Japanese fisheries landings (in t) of the North Pacific stock of bastard halibut, separated by gear type. Data available at http://abchan.fra.go.jp/digests2017/index.html

Year	Offshore trawl (沖底)	Small trawl (小底)	Gillnet (刺網)	Set net (定置網)	Other (その他)	Total
2007	307	555	1114	578	145	2699
2008	220	423	936	469	105	2153
2009	381	455	858	434	116	2247
2010	*	420	1206	531	152	2630
2011	*	230	533	*	113	1534

2012	*	187	241	*	164	1170
2013	478	434	809	744	159	2624
2014	319	665	1029	819	168	3001
2015	640	677	923	690	160	3107
2016	346	504	777	552	153	2332

Table 2. Number of bastard halibut seedlings released over time (in thousands of individuals). Data available at http://abchan.fra.go.jp/digests2017/index.html

Year	Aomori	Iwate	Miyagi	Fukushima	Ibaraki	Total
2006	1,040	1,113	290	1,040	973	4,456
2007	1,035	1,210	220	1,040	805	4,310
2008	929	1,282	268	1,040	962	4,481
2009	940	1,518	440	1,022	1,001	4,921
2010	868	1,472	639	1,030	818	4,827
2011	712	0	30	0	4	746
2012	995	252	203	100	117	1,667
2013	615	192	220	100	417	1,544
2014	312	0	20	100	280	712
2015	326	501	170	100	234	1,331

Unit of Assessment(s)

The Unit of Assessment is bastard halibut from the North Pacific stock caught by small bottom trawl, bottom gillnet, and set net.

Status of target stock(s) - Principle 1

The Fisheries Research and Education Agency of Japan (FRA) evaluates stock status (low, medium, or high) relative to reference points that are determined by historical data and are not directly linked to maximum sustainable yield (MSY). For bastard halibut, biomass is estimated via cohort analysis and used as the stock status indicator. The total range of past biomass

estimates is divided into three parts, and the part that the most recent abundance estimate falls into determines the status. A type of limit reference point (B_{limit}) has also been estimated for this stock. There is no target reference point.

Fishing effort in Japan is largely regulated through input controls (Makino 2011). For bastard halibut, effort is managed by regulating the number of vessels that can fish, and some prefectures or fishery cooperatives implement fishery openings and closures. In terms of output controls, there are minimum size limits but not catch limits.

Stock status outcome (1.1.1)

Scoring category	Green

Rationale:
Biomass, estimated using cohort analysis, is used as the stock status indicator. The threshold between low and medium status is 2,036 t, while the threshold between medium and high status is 4,072 t (Kurita et al. 2017). In 2016 the estimated biomass resulted in a determination of high status, and biomass showed an increasing trend from 2012 to 2016 (Kurita et al. 2017; Fig. 2). Dominant year classes often appear once or twice every ten years (Watanabe and Fujita 2000). Halibut fisheries are enhanced through release of artificially produced juveniles, which makes determination of the status of the wild population more difficult. However, there was a sharp reduction in enhancement activities following the 2011 earthquake, with the average number of juveniles released per year failing from 4.6 million in 2006-2010 to 1.2 million in 2011-2015 (Kurita et al. 2017). Thus the high status in recent years is likely more reflective of wild population abundance. Additionally, there appears to be a somewhat inverse relationship between total estimated catches and the proportion of artificially origin halibut in the catch (Table 3), which suggests that the wild population abundance is not dependent on artificial seedling production.

Fishing mortality is also estimated in the stock assessments. Catch levels tend to vary around a 10 to 20 year cycle (Fig. 3).

According to a preliminary, MSY-based assessment conducted in March 2018 for the Council for Promotion of Regulatory Policy Reform, the North Pacific stock of bastard halibut was at a sustainable abundance level in 2015, with an SSB_{2015} / SSB_{MSY} ratio of 1.15.
Based on all of the information above, stock status is likely above a limit reference point and fluctuating around MSY.

Table 3. Estimated catch from the stock assessment model, and estimated proportion of artificial origin halibut in the catch. Data available at: http://abchan.fra.go.jp/digests2017/index.html

Year	Estimated catch (t)	Proportion of artificially produced halibut (%)
2004	1118	13.6
2005	1557	15.3
2006	2603	9.9
2007	2220	6.6
2008	2262	12.0
2009	2375	8.3
2010	2202	4.5

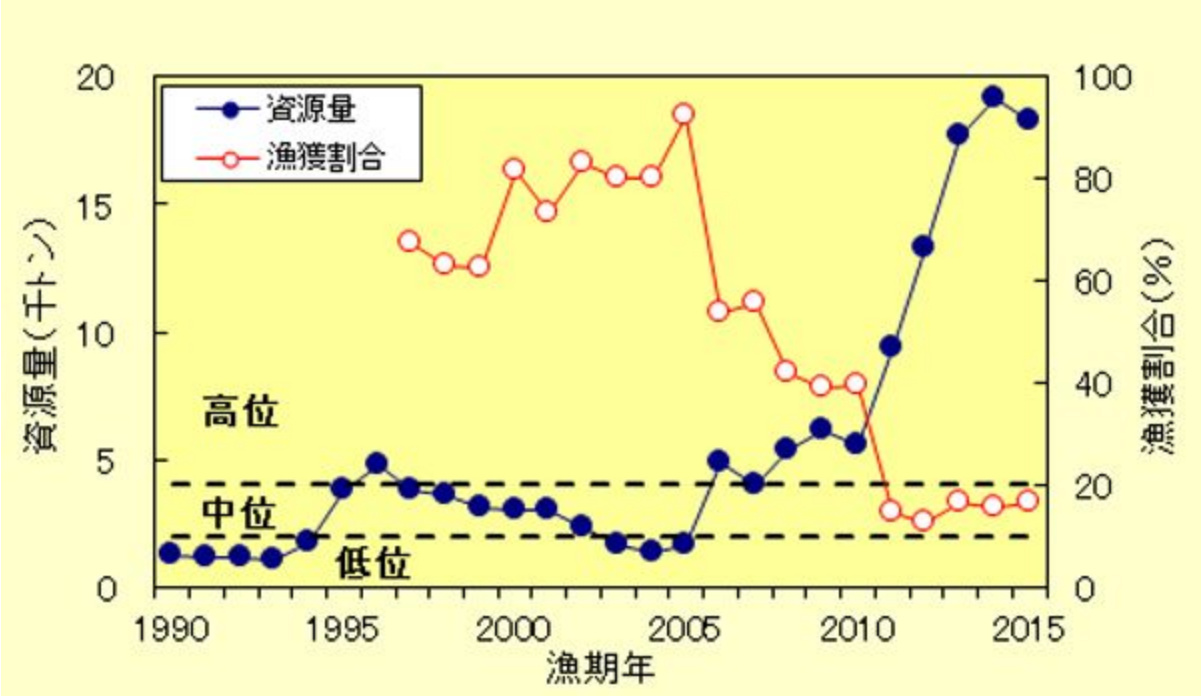

Figure 2. Estimated North Pacific bastard halibut biomass level (blue circles, in thousands of t) and exploitation rate (white circles, catch divided by estimated biomass) over time. The dashed lines separate the thresholds between high (高位), medium (中位), and low status (低位) level. Figure from http://abchan.fra.go.jp/digests2017/html/2017_57.html

Figure 3. Estimated fishing mortality rate F over time.

Stock rebuilding outcome (1.1.2)

Scoring category	Not considered

Rationale:
This indicator does not need to be scored if stock status outcome has a green score.

Harvest strategy (1.2.1)

Scoring category	Yellow

Rationale:
Information collected to support the harvest strategy includes landings at major ports, size composition data, and research conducted by the Japan Fisheries Agency and national research institutes (Kurita et al. 2017). FRA scientists assess the stocks every year and estimate an acceptable biological catch (ABC) for each stock. Gear specifications (e.g. minimum mesh size) and fishery closed seasons and areas are used to maintain productivity and manage fishing effort. However, as is typical for Japanese fisheries, there are no harvest control rules (HCRs). All harvest strategy components required by the MSC standard, excluding HCRs, are present.

The harvest strategy could theoretically maintain stock biomass around a target reference point (TRP).

Harvest control rules (1.2.2)

Scoring category	Not considered

Rationale:
Since harvest control rules are not currently used in Japanese fisheries management, this indicator is not considered. There are no official harvest control rules (HCRs) for bastard halibut stocks. Under MSC guidance, 'available' HCRs may be accepted and evaluated in cases where the stock has been maintained at an MSY level and not shown any evidence of recruitment impairment (MSC FCR v2.0, p.120). Recent evaluations suggest that recruitment has not been impaired, so it may be possible to consider the estimation of an ABC and use of stock status reference points as 'available' HCRs. However, it is uncertain whether exploitation will be reduced significantly in response to stock depletion.

Information and monitoring (1.2.3)

Scoring category	Yellow

Rationale:
Landings information has been collected since 1940, and body length information has been collected for subsampled halibut that has been landed at ports (Kurita et al. 2017). This information is likely sufficient to support a harvest strategy.

Assessment of stock status (1.2.4)

Scoring category	Green

Rationale:
Scientists at the Japan Fisheries Research and Education Agency (FRA) assess bastard halibut stocks annually. These assessments estimate biomass and determine stock status relative to reference points based on historical biomass estimates (Kurita et al. 2017). Landings information is collected for all major gear types. The assessments are reviewed internally and also externally by experts and officials (JFA and FRA 2015). The stock assessment determines an ABC_{target} that is set at 80% of the ABC_{limit} to account for uncertainty in estimation of ABC, but ABC is a recommendation rather than a binding catch limit. The assessment appears appropriate to the species and could be used to develop an HCR.

Ecosystem impacts - Principle 2

Bastard halibut is primarily caught by small bottom trawl (小型底びき網), gillnet (刺網) and set net (定置網). In terms of Japan's total harvest, small bottom trawls catch about 22% of the harvest, gillnets about 34%, and longlines about 27% (http://www.maff.go.jp/j/tokei/kouhyou/kaimen_gyosei/index.html). In addition to bastard halibut, small trawls catch many different species including other flatfishes, squids, and octopuses. Gillnets and set nets may also catch a variety of species, but as with trawls, catch composition is highly dependent on fishing location and practices.

Although MAFF compiles national-level catch statistics separated by fishing gear, there are no catch composition data for fishing vessels that are specifically targeting bastard halibut. Japanese fishers are not required to keep records on discards or bycatch, though they sometimes record catches of commercially important species. Species information regarding bait, which is typically used with longlines but not bottom trawls or gillnets, is also not available. Since information on other species caught is very limited, we used information from Unknown Bycatch Matrices developed by the Monterey Bay Aquarium Seafood Watch Program to consider fishery impacts on other, non-Pacific cod species.

Other species information (2.2.3)

Scoring category	Not considered

Rationale:
Due to the lack of bycatch monitoring, including fishery-specific data on other species caught and retained, insufficient information is collected to inform bycatch management and determine the fishery's risk to these other species.

Other species outcome (2.2.1)

Scoring category	Not considered

Rationale:
This indicator is not considered due to lack of information.

Other species management (2.2.2)

Scoring category	Not considered

Rationale:
This indicator is not considered due to lack of information.

ETP species information (2.3.3)

Scoring category	Not considered

Rationale:
This indicator is not considered due to lack of information. There is no standardized monitoring of bycatch species in Japanese fisheries (Fukutake et al. 2014), and fishers do not usually record data on encounters with ETP species. Qualitative information about ETP species mortality resulting from the assessed fishery is not available.

ETP species outcome (2.3.1)

Scoring category	Not considered

Rationale:
This indicator is not considered due to lack of information. However, we used the SFW Unknown Bycatch Matrix information to consider likely impacts on turtles, seabirds, and sharks from bottom trawl and bottom gillnets in the North Pacific or Northwest Pacific Ocean. The matrices do not have a category for set nets, which are a type of trap. Fishes caught by set net generally stay alive in good condition and can be released.

According to the SFW Unknown Bycatch Matrix, impacts of bottom trawls were rated as follows (Table X). Level of concern regarding fishing mortality is marked by the following colors: high concern = red, medium concern = yellow, and low concern = green.

For benthic invertebrates, finfish, forage fish, and corals, impacts were not determined by region, and SFW did not assign concern categories. Highest impacts receive a score of 1, and lowest impacts receive a score of 5.

Table X1. Impacts of bottom trawls, bottom gillnets, and bottom longlines based on the Monterey Bay Aquarium SFW Unknown Bycatch Matrices.

Bycatch susceptibility category	Region	Bottom trawl	Bottom gillnet
		Score	Score
Sea turtle	North Pacific	3	2
Marine mammal	Northwest Pacific	1	1
Seabird	Northwest Pacific	2	1

Shark	Northwest Pacific	1	2
Benthic invertebrates	N/a	2	3
Finfish	N/a	2.5	2
Forage fish	N/a	2	2
Corals and other biogenic habitats	N/a	1	2

ETP species management (2.3.2)

Scoring category	Not considered

Rationale:
Since no information is available on the specific ETP species that may be affected, we could not score this indicator.

Japan has a Red Data Book identifying ETP species found within the country. In terms of national legislation, there is a Law for the Conservation of Endangered Species of Wild Fauna and Flora (Law No. 75) that aims to conserve endangered species and contribute to conservation of the natural environment (Ministry of the Environment 2016a). There is also a Wildlife Protection and Hunting Law (Law No. 32) that protects birds and mammals by establishing wildlife protection areas (Ministry of the Environment 2016b).

Habitats information (2.4.3)

Scoring category	Yellow

Rationale:
Bastard halibut is a benthic species that is fished on or close to the sea bottom. Bottom gillnets and set nets are typically set over sandy or muddy substrates, while trawls are dragged close to or along such substrates. According to SFW guidance, bottom gillnets can be considered to have low habitat impacts when used over resilient mud/sand habitat, while bottom trawls used over such habitats have moderate impacts. FAO gear descriptions note that bottom trawls usually interact with bottom sediments, potentially resulting in removal or damage of benthic organisms and objects (FAO 2001). The Japan Coast Guard hosts a map website (CeisNet: http://www1.kaiho.mlit.go.jp/JODC/ceisnet/index.html) that includes maps of benthic habitats and sensitive areas such as coral reefs.

In summary, the types and distribution of commonly encountered habitats and the nature of gear impacts upon those habitats is broadly understood. However, data are not adequate for verifying efficacy of habitat management measures and determining risks to habitat from this specific fishery.

Habitats outcome (2.4.1)

Scoring category	Yellow

Rationale:
The main encountered habitats (sand and mud) are resilient, and thus bastard halibut fisheries appear unlikely to reduce structure and function of the commonly encountered habitats to a point where there would be serious or irreversible harm. However, it cannot be said that serious impacts are highly unlikely, especially for trawl gear since it contacts the bottom.

Habitats management (2.4.2)

Scoring category	Yellow

Rationale:
Bottom trawls cannot be operated within coastal areas according to the Basic Fishery Law (Article 52, Paragraph 1)[1]. There are fewer explicit restrictions on operations of bottom gillnets and set nets, though their habitat impacts are expected to be relatively low. However, the effectiveness of habitat measures has not been tested, and there is no quantitative evidence that they are being implemented successfully.

Ecosystem information (2.5.3)

Scoring category	Yellow

Rationale:
Trophic relationships involving bastard halibut are broadly understood, but ecosystem impacts of halibut fisheries do not appear to have been studied in detail. There does not appear to be sufficient monitoring in place to detect increases in ecosystem risk level. After settling on the sea bottom, juvenile halibut prey on small shrimp-like crustaceans (orders Mysida and Lophogastrida). As adults they transition to consuming fishes and squids. They are subject to cannibalism by other members of their cohort and are preyed upon by other fish species and shrimps (e.g. genus Crangon; Furuta 1998). If predation is intense, halibut recruitment may be negatively affected.

[1] http://jamarc.fra.affrc.go.jp/enganbiz/bizbox/sokobikiami/okisokotoha/okisoko.htm

Ecosystem outcome (2.5.1)

Scoring category	Yellow

Rationale:
Fisheries harvest large quantities of bastard halibut, but CPUE has been high in recent years, suggesting that the stock is not currently in a depleted state. There is significant aquaculture of bastard halibut, where juveniles are artificially produced from broodstock and released into the wild. Information on the ecological impacts of these releases is starting to be collected, but the impacts are still largely not understood (Kurita et al. 2017). The scale of releases has been reduced since the 2011 earthquake, and productivity of the wild stock does not appear to depend on releases of hatchery produced juveniles (Table 3). If juveniles are produced in an ecologically responsible manner, for example by using genetically diverse broodstock collected from abundant wild populations, ecological impacts from enhancement may be minimized.

More information on artificial production practices would be useful to obtain, but overall, halibut fisheries appear unlikely to disrupt key ecosystem elements to a point where there would be serious or irreversible harm.

Ecosystem management (2.5.2)

Scoring category	Yellow

Rationale:
The Japanese fisheries management system focuses primarily on target species and currently lacks an ecosystem-based approach, although some policy documents, such as the Fisheries Policy of 2001, state that ecosystems should be conserved (Makino 2011). Halibut harvests are not managed to minimize negative ecosystem impacts, but stock assessments do include estimates of ABC that could potentially be used to manage impacts.

The 2011 Japan Ministry of the Environment document titled ‘Marine life diversity conservation strategy’ (海洋生物多様性保全戦略) suggests a general movement toward policies that protect marine diversity and promote the sustainable use of marine resources (Fukutake et al. 2014). Relevant management measures include implementation of Marine Protected Areas (see Makino 2013). Conservation policy strategies are established by the Marine Diversity Conservation Specialist Investigative Commission (海洋生物多様性保全戦略専門家検討会), which holds meetings and receives public comments.

Management - Principle 3

Japan's fisheries are managed on multiple levels. The national management body is the Fisheries Agency of Japan (JFA) within the Ministry of Agriculture, Forestry, and Fisheries (MAFF). Prefectural governments administer fishing rights and licenses within their jurisdictions (Makino 2011). At a smaller scale, fisheries are managed by fishery cooperative associations, whose membership consists of fishermen and small fishing companies. These cooperatives tend to be defined by region, target species, and/or gear type. Management is coordinated among all these levels, generally with the JFA and prefectural governments issuing regulations and the fishery cooperatives implementing those regulations (McIlwain 2013). In Japan there is an emphasis on resource users actively contributing to management of their own fisheries, and fishery cooperatives have considerable influence in determining operational rules (e.g. gear restrictions) and setting fishery openings and closures (Uchida and Watanabe 2008, Makino 2011).

Legal and/or customary framework (3.1.1)

Scoring category	Green

Rationale:
Fisheries governance in Japan is supported by an effective national legal system with binding procedures governing cooperation with other parties, and the system is capable of delivering management outcomes consistent with 1) management of the stock to a sustainable level and 2) minimising impacts on other species, habitats, and wider ecosystem components. The legal system aims to guarantee justice and transparency in administrative management, and there is a clear decision-making process for determining fishery measures and dealing with disputes as they arise (Fukutake et al. 2014). The system has a mechanism to observe the legal rights of people dependent on fishing for food or livelihood.

The Fisheries Law of 1949 outlines a framework for managing fisheries via fishery rights and licenses that are controlled by the government (Makino 2011).

Consultation, roles, and responsibilities (3.1.2)

Scoring category	Green

Rationale:
Functions, roles, and responsibilities are clearly defined and understood in the national management framework. The Japanese Fisheries Policy Council has a key role in seeking and accepting relevant information from stakeholders, which may then be incorporated into

management measures. The JFA regularly offers opportunities for stakeholders, including fishing industry members, to participate in public consultation processes (Fukutake et al. 2014).

Additionally, the JFA supports economic incentives for sustainable fishing by providing some degree of compensation for income loss resulting from management measures (Makino 2011).

Long term objectives (3.1.3)

Scoring category	Green

Rationale:
The Fisheries Basic Act (2001) describes the overarching framework for fisheries management in Japan. Chapter 1, Article 2 states a requirement to manage fisheries resources to ensure their sustainable use as a component of marine ecosystems, following the recommendations of UN Convention on the Law of the Sea (UNCLOS). The Law of Conservation and Management of Marine Living Resources states the need to protect surrounding ecosystems and habitats. Thus long term objectives consistent with the precautionary approach and appropriate management of target stocks and ecosystem impacts are explicit within management policy.

Fishery-specific objectives (3.2.1)

Scoring category	Yellow

Rationale:
Individual prefectures that fish this stock may have some management objectives and/or measures in place, e.g. as described in the Ibaraki Prefecture Resource Management Guidelines for 2011 to 2016 (http://www.jfa.maff.go.jp/form/pdf/8ibaraki.pdf). For example, the stated management objective for bastard halibut is to maintain catches at a stable level. The document also mentions that a minimum harvestable size for halibut and some protected areas were implemented starting in 1991. For major gear types, measures such as fishery openings and closures are mentioned.

Based on the Ibaraki Prefecture Resource Management Guidelines, implicit objectives that are consistent with appropriate management of target stocks and ecosystem impacts appear to exist. However, explicit objectives consistent with the precautionary approach are not apparent.

Decision-making processes (3.2.2)

Scoring category	Yellow

Rationale:

Status of the fishery and fish stocks are reviewed at least once per year. These reflect the existence of decision-making processes that result in measures for achieving fishery-specific objectives, and suggest that the processes respond to monitoring and evaluation results. Some information on the fishery's performance is available in materials posted on the FRA and MAFF websites. There is no indication that management authorities or fishers repeatedly violate regulations necessary for sustainability of the fishery. However, it is not apparent that decision-making processes employ a precautionary approach.

Compliance and enforcement (3.2.3)

Scoring category	Yellow

Rationale:
Fishing effort appears to be primarily regulated through permits and limited entry to the fishery. The JFA and Japan Coast Guard engage in some enforcement activities such as checking fishing logbooks and permits, and clear provisions exist for penalizing individuals or parties who violate fishery regulations (Clarke 2007). Thus MCS mechanisms exist and are implemented. These mechanisms are expected to be reasonably effective, and there are no reports of systematic non-compliance. More information on application of sanctions and evidence of compliance would be needed to score this indicator green.

Monitoring and management performance evaluation (3.2.4)

Scoring category	Yellow

Rationale:
Key components of the fishery-specific management system include monitoring and evaluation of stock status, management of ecosystem impacts (e.g. catches of other species and habitat issues), and performance of the compliance and enforcement system. Stock assessments are regularly evaluated and subject to internal review, but it is not clear whether the other components are regularly evaluated and adapted.

References

Chen, E. 2014. Monterey Bay Aquarium Seafood Watch Report: Pacific cod, Japan. https://www.seafoodwatch.org/-/m/sfw/pdf/reports/c/mba_seafoodwatch_japanpacificcodreport.pdf

Clarke, S. 2007. Illegal fishing in the Exclusive Economic Zone of Japan. Report prepared for MRAG, Ltd.

Food and Agricultural Organization of the United Nations. 2001. Fishing Gear types. Bottom trawls. Technology Fact Sheets. In: FAO Fisheries and Aquaculture Department [online]. Rome. Updated 13 September 2001. [Cited 2 October 2018]. http://www.fao.org/fishery/geartype/205/en

Fukutake, C., T. Matsuishi, and I. Nagano. 2014. MSC漁業審査規準を用いたスケトウダラ太平洋系群を対象とする漁業の持続可能性の評価. [Sustainability assessment of the Pacific walleye pollock stock against the MSC standard.] Bulletin of Fisheries Sciences, Hokkaido University, 64(3):83-87.

Furuta, S. 1998. Behavioral and ecological studies on the development of artificial seedling release techniques of bastard halibut in Tottori prefecture. (In Japanese.) Tottori Water Experiment Report 35: 1-76.

Japan Fisheries Agency and Fisheries Research Agency. 2015. [Implementation System of Stock Assessment.] (In Japanese.) http://abchan.fra.go.jp/taisei.html

Kurita, Y., H. Togashi, T. Hattori, and Y. Shibata. 2017 stock assessment of the North Pacific stock of Japanese flounder. (In Japanese.) http://abchan.fra.go.jp/digests2017/details/201757.pdf

Makino, M. 2011. Fisheries management in Japan: its institutional features and case studies (Vol. 34). Springer Science & Business Media.

Makino, M. 2013. Japan chapter in Marine protected areas: Country case studies on policy, governance and institutional issues. Compiled by J. Sanders, D. Gréboval, and A. Hjort. FAO Fisheries and Aquaculture Technical Paper 556/2. http://www.fao.org/3/a-i3212e.pdf

McIlwain, K. 2013. Catch Shares in Action: Japanese Common Fishing Rights System. Environmental Defense Fund. http://fisherysolutionscenter.edf.org/sites/catchshares.edf.org/files/Japanese_Common_Fishing_Rights.pdf

Ministry of the Environment 2016a. Law for the Conservation of Endangered Species of Wild Fauna and Flora (Law No. 75).

Ministry of the Environment 2016b. Wildlife Protection and Hunting Law (Law No. 32). https://www.env.go.jp/en/nature/biodiv/law.html

Watanabe, M. and Fujita, T. 2000. Large size year classes of Japanese flounder Paralichthys olivaceus produced in 1994, 1995. Fukushima Pref. Fish. Exp. Stat. No. 9.