

# Analyses on the Factors Affecting Consumer's Consciousness Related to Aquatic Resources and Products

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## Summary

In Japan, there has been a long history of consumption of fishery products as main source of protein intake against the background of abundant variety of fishery products for fish catching and edible use. However, in recent years, quantity of consumption for fishery products is declining with the centralization of consumption to some specific fish stocks. On the other hand, in the adjacent seas in Japan, reduction of the good fishery resources by over catching causes a price slump of fishery products, and there is a growing anxiety about worsening fishery operators' business performance. In order to realize a sustainable development of fisheries and satisfy both of the protection of fishery resources and its appropriate use, the support from the consumer side is also considered to be important.

In this paper, the consumer's consciousness and behavior toward fishery products and the factors that influence them will be clarified. It will also draw policy implications on the construction of a sustainable development of fisheries and the establishment of sea food system. As a method of research, the large-scale questionnaire survey was carried out for the consumer demographics both of producing and consuming regions (3 prefectures in Hokuriku District and Tokyo). In addition, the analysis of Structural Equation Modeling was applied to the result of the questionnaire, and consumer's consciousness structure toward fishery products was clarified.

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## 1. INTRODUCTION<sup>1</sup>

Hunger eradication is an essential issue for sustainable development while sustainable consumption and production system are essential to eradicate hunger and protect ecosystem. This requires policies that create incentives for producers and consumers to adopt sustainable practices and behaviour (FAO, 2012, p.89; Rio +20<sup>2</sup>).

World consumption of sea food products per capita steadily increased by 3.2% of the average annual growth rate in 1961 to 2009, and amounts to 18.4 kg in 2009(FAO, 2012). And the consumption of seafood is not distributed evenly, and considerably regional differences occur (Swartz *et al.*, 2010). In Japan, quantity of consumption for fishery products is declining with the centralization of consumption to some specific fish stocks. The intake of seafood decreased with a peak of around 1997, and the intake of meat exceeded it in 2006, and it will be in the tendency which the difference expands. Moreover, decreasing of the intake of aquatic

products and increased of the intake of meat products arise in all the age groups<sup>3</sup>.

On the other hand, in the adjacent seas in Japan, reduction of the good fishing resources by over catching causes a price slump of fishery products, and there is a growing anxiety about worsening fishery operators' business performance. In order to realize a sustainable food system of aquatic products from economical, environmental and social aspects, the behavior of the economic entities including producers, distributors and consumers that contributes to satisfying both of the protection of fishery resources and its appropriate use should be taken into account in the fishery policies and programs.

In this paper, the consumer's consciousness and behavior toward fishery products and the factors that influence them will be analyzed in order to draw policy implication contributing to the construction of a sustainable sea food system which covers the problems of fisheries such as the flow of aquatic products and the environment surrounding it.

## 2. POLICY AND LITERATURE REVIEW

### 2.1 Fishery Policies in Japan

In Japan, there has been a long history of consumption of sea food as main source of protein intake against the background of abundant variety of fishery products for fish catch and edible use due to various marine organisms inhabit the surrounding ocean area where cold current and warm

<sup>1</sup> Earlier version of this paper was presented at the *23rd Conference of PRSCO 2013(2-4 July, 2013, Bandung, Indonesia)*.

<sup>2</sup> FAO's corporate message to Rio+20 message (<http://www.uncsd2012.org/rio20/>)

<sup>3</sup> Ministry of Health, Labour and Welfare of JAPAN, *National Health and Nutrition Survey* (Each Year).

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current cross. Moreover, original recipes and preservation methods are produced in different parts of the country, forming the 'fish-eating culture' (Fisheries Agency, 2012).

However, Japanese fisheries faced with falling production of fish catching and aquaculture against the background of the low level of fish stock, and the decreasing of the numbers and ageing of fishery operators. On the other hand, trend of decrease of the fishery consumption continued along with the structural changes of consumption both of the quantity and quality aspects partly due to the changes in lifestyle and consumer preferences (OECD, 2012b; Fishery Agency, 2012). Therefore, for the development of fishery food system in Japan, sustainable supply of fishery products based on the adequate management of resources, the cultivation of competitive fishery business and responding to the structural changes of consumption are simultaneously called for.

Direction of Japanese fishery policy should have been shifted from the producer policy to the integrated policy including the consumer policy, enacting the *Basic Law of Fisheries Policy* in June 2001. The purposes of the basic law are to secure a stable supply of fishery products to Japanese people and to promote the national economy by i) Sustainable management of marine resources and ii) Development of entire fishing industry including the related industry such as processing and distribution. In accordance with the basic law, a new basic plan of fisheries was developed in March 2012. Policies and programs in the new plan have been implemented based on the following principles: i) Recovery from the Great East Japan Earthquake, ii) Full use of fishery resources based on resource management and sea farming, iii) Supply of fish and fishery products, iv) Development of safe and vibrant fishing communities (Fishery Agency 2012). Table 1 summarized the policies and programs of the new plan from the viewpoint of food system. However, it is clear that the priority of Japanese fishery policies is still been put

on the producer side although more than ten years have passed since the basic law was implemented.

Therefore, in order to resolve the issue of fishery resources management and the sustainability of fishery industry, producer policy (promoting the cooperation among producers), consumer policy (promoting consumers themselves to choice green products) and food system policy (including producers, consumers and distributors) should be taken into account. Furthermore, for the sustainable development of sea food system, designing and implementing the policy which contributes to solve the problems of the overall food system is required while it also should solve the specific problems of each sector and domains (Kiminami, 2009). However, most of existing studies on fishery policies is focused on the producer side such as the issue of resource management and fishing right, and structure of fishery industry etc., and the studies focusing on the consumer's consciousness from the view point of sustainability of food system are scarce.

In the followings, existing studies about the producer and consumer policies around the issues of fishery resources management are reviewed with the clarification of the agendas for policy researches.

## 2.2 Existing Studies and Policies on the Fishery Resource Management

The well-being of future generations will depend on the ability of the present generation to better integrate natural systems and the goods and services they provide into the global economy and market transactions. As long as natural capital remains external to transactions, management of such capital for sustainability seems difficult and possibly ineffective. In terms of marine living resources, two specific external problems are the over-capitalization and overharvesting of fisheries, and adverse impacts of fishing

**Table 1.** Fishery Policy in Japan

Sector	Food System			
	Resource and Environment/ Region	Producer	Distribution and Processing industries	Consumer
Domains of Policies and Programs	<ul style="list-style-type: none"> <li>• Fishery resource management</li> <li>• Development of safe and vibrant fishing communities</li> </ul>	<ul style="list-style-type: none"> <li>• Business management stability of motivated fishery operators</li> <li>• Vibrant production structure based on the diverse development of businesses</li> <li>• Safety measures for vessel fishery</li> <li>• Reorganization of fisheries-related organizations</li> </ul>	<ul style="list-style-type: none"> <li>• Measures for quality and hygiene control</li> <li>• Construction of diverse distribution routes</li> <li>• Increased added value based on processing and expansion of sale channel</li> <li>• Ensuring the balance of supply and demand by fulfilling the functions</li> <li>• Promotion of export</li> </ul>	<ul style="list-style-type: none"> <li>• Information dissemination to consumers</li> <li>• Promotion of fish consumption based on the education</li> </ul>
	Enhancement of technological development and investigate research			

Source: Summarized from the Fishery Agency in Japan, *Basic Plan of Fisheries* (March 2012 ).

[http://www.jfa.maff.go.jp/j/policy/kihon\\_keikaku/pdf/suisankihonkeikaku\\_honbun.pdf](http://www.jfa.maff.go.jp/j/policy/kihon_keikaku/pdf/suisankihonkeikaku_honbun.pdf)

activities on associated and dependent species and habitats (Gibbs and Thébaud, 2012).

On the other hand, natures of the issue of fishery resources management root in the situation that negative externality occurred among producers and consumers (current generation and future generation) due to the increasing capacity of fishing and constraint of fishery resources<sup>4</sup>.

### 2.2.1 Producer's Behavior and the Problems about the Regulation of Resource Management

According to the Prendergrast *et al.* (2008) and OECD(2012a), factors affecting on the producer's behavior can be classified into the following three factors: (i) External factors (related to the economic incentives such as money, time/effort), (ii) Internal factors (customs and cognition) and (iii) Social factors (social capital, etc.). And, it is considered that the conventional approach couldn't achieve the policy objectives because the 'traditional market intervention' approach mainly focused on the external factors<sup>5</sup>. Therefore, adopting 'traditional market intervention' and 'behavioral economics intervention' approaches complementarily have become important based on the analysis of the cognitive process such as the internal factors and social norms that affecting on the producer's behavioral changes.

As one of the approaches of fishery resources management, systems of TAC (Total Allowance Catch) that restrict the amount of fishing are utilized in the number of fish items, countries and regions. TAC has three

systems (Tables 2): Olympic system (it restricts the total amount of fishing, but it provides producers with strong incentives to catch the fish faster and more), IQ system (it assigns fish catch quota (cap frame) for every fishing boat), ITQ system (it enables the market transaction of fish catch quota and realizes the improvement of efficiency of the market as a whole).

As of three systems, IQ and ITQ have the strength and the weakness respectively. Important point is to utilize the measures to induce the voluntary cooperative behavior through the endogenous motivation and the improvement of social norms as well as measures of the regulations<sup>6</sup>.

### 2.2.2 Studies on the Consumption of Aquatic Products

Tasaka (2005, p.165) summarized the researches on the consumption of fishery products in Japan and pointed out the following five fields as the future research directions: (i) Analysis on the consumption considering the non-price factors; (ii) Layered structure of regional characteristics of the consumption by combining culture and changing factors; (iii) Analysis on the consumption in the framework of food system; (iv) Analysis on the processed food market by utilizing the objective data; (v) Analysis on the food safety issues including the food labeling and reputation. As for the (ii), Ariji (2011) analyzed the regional disparities of consumer preferences about tuna by utilizing the conjoint analysis of the questionnaire survey on the internet, and clarified that WTP (willingness to pay) of consumers in Tokyo was statistically higher than in other regions. Ogawa [14] clarified

**Table 2.** Advantages and disadvantages of fishery resource management regulations

TAC	Strengths	Weaknesses	Country <sup>1)</sup>
Olympic System	-	A lack of high-quality fishing (For act quickly)	Japan
IQ System	Resource conservation Management stability (short-term)	High Monitoring cost Possibilities of government failures	Korea, Japan (small part such as the model project in Niigata Prefecture)
ITQ System	Improvement of efficiency (medium and long term) Resource conservation	Concern to market oligopoly Decline of the vitality of fishing villages	Iceland, Norway, Denmark, New Zealand, Australia, the United States

Note: 1) Listed countries are based on the Niigata Prefecture (2011, p.9).

The details of institutional design of each system are very different in each country and species.

<sup>4</sup> Market mechanism may work because increase of price along with exhaustion of resources. This is the case where (i) price elasticity of demand is small and (ii) fishery operator's production cost goes up with reduction of resources. In this case, while reduction in the fish catch leads to the rise of the price, and reduction of demand, as a result of fish catch expense's going up, each fishery operator stops a fishery and marine resources recover him in the long run.

<sup>5</sup> The conditions that the incentive of a producer's cooperation works in order to manage common-pool resources are (i) fishing right, (ii) the specific fishermen's cooperative association is using ocean space monopolistically in the area along the shore, and (iii) diadromous level of fishes are low (it is rare to move across a boundary). However, in actual fishery resource management, even if it has met the three above-mentioned conditions, it cannot be said that it has succeeded in resource control.

<sup>6</sup> The government of Niigata Prefecture introduced IQ (Individual Quota) System in a tentative way for deep water shrimp (*Pandalus eous*) from the 2011 fiscal year, which assigns fish catch quota (cap frame) for every fishing boat aimed at preventing excessive fish catch and enabling fishery operators to have appropriate operation based on the market condition.

that consumer's purchasing criteria on the fishery products could be explained by the value-added factor and the appearances factor<sup>7</sup>.

On the other hand, Unnevehr *et al.*(2010, p.516) reviewed the trend of researches on consumer behavior in the field of agricultural economics, and pointed out that one of the most important research tasks is to clarify the motivation of consumers who choose the healthy dietary life against the background of obesity and its social problems in developed and developing countries.

With regard to the consumer behavior of green products, the recent studies clarified that environmental morale and motivation, internalized norms, and intrinsic motivation affect consumers' purchasing attitude of green products (Brécard *et al.*, 2009). Therefore, consumer behavior of green products can be explained by the complex interaction of (i) external factors (condition of constraints), (ii) internal factors (motivation, preference, custom, and cognition) and (iii) social factors (social capital). Taking the 'fast-fish program' implemented recently in Japan as the example of the external factors, which is considered to resolve the constraints of time and skill of cooking and contribute to the purchasing of fishery products temporarily. However, effectiveness of the program is doubtful if the constrain rebound after the expiration of the program. As of the cognitive factors of internal factors and social factors, such as intrinsic motivation through environmental education, correction of the cognitive bias through providing accurate information, and improvement of social norms through participating in the activity of resource management contribute to the changes of consumer's consciousness in the long run. Therefore, the cognitive process of consumers such as internal factors and social norms as well as external factors needs to be clarified when consumer policy is constructed<sup>8</sup>.

### 3. ANALYTICAL METHOD AND DATA

As a method of research, the large-scale questionnaire survey was carried out for the consumer demographics both of producing and consuming regions (3 prefectures in Hokuriku District and Tokyo). In addition, the analysis of Structural Equation Modeling was applied to the result of the

questionnaire, and consumer's consciousness structure toward fishery products was clarified.

Data used in this study is the piece vote data of the questionnaire about the dietary life implemented by the MACROMILL, INC. in July 2012. Number of the respondents are 1,400 of the monitor. Residents of the respondents are Tokyo (500 sample), Niigata (500 sample)<sup>9</sup>, Toyama (200) and Ishikawa(200). The age (20s, 30s, 40s, 50s, over 60 years old) and sexes(Male, Female) of respondents are equal layout. And the annual household income is set to be more than 4 million yen. The main investigation items are the dietary life, consumption of fishery products and shrimps and unfamiliar fresh fishery products in addition to the social economic attributes such as sex, age, residence, occupation and income.

In this study, SEM (Structural Equation Modeling) analysis<sup>10</sup> is applied to the results of the questionnaires, and it tries to clarify the formation process of consumer's consciousness toward the fishery products.

Table 3 shows the setting variables and factors which affect the changes of consumer behavior based on the previous works such as OECD(2012a), Prendergrast *et al.*(2008) and Brécard *et al.*(2009).

## 4. ANALYTICAL RESULTS

### 4.1 Preparations of Variables for the Analysis

#### *Fish Eating Preference*

With regard to the frequency of fish and meat eating, "It is the about the same." was 35.7%, "It is rather meat." was 27.9%, "It is rather fishery products." was 19.4%, "Fishery products are eaten in many cases" was 11.9%, and "Meats are eaten in many cases." was 5.1%. And, integral numbers of score of 5 to 1 are given in order with the high degree of fish eating preference.

#### *Consciousness of Dietary Habits and Its Motivation*

Table 4 shows the results of the quantification method type 3 on the consciousness of dietary habits. According to the results, 1st axis can be interpreted as the "Interest and Activity (High-Low)", 2nd axis can be interpreted as the "Health and Nutrition Intention (High-Low)" and 3rd axis can be interpreted as "Social Relationship Intention (High-Low)".

Table 5 shows the results of the quantification method type 3 on the motivation behind dietary habits (Joy and

<sup>7</sup> Although there are many researches on the segmentation technique of consumers about agricultural products(for example, Isojima, 2006), research on the marine products is few.

<sup>8</sup> The purchasing conditions of environmental consideration goods such as fishery Eco-label goods are consumer's high environmental normative consciousness, and signaling of the information by label display is performed appropriately. Yukimoto *et al.* (2012) [19] clarified that consumer's behavior is affected by the logical information offering about the resource management in the long run.

<sup>9</sup> Niigata Prefecture implemented the IQ system in Akadomari are in Sado. It consists of the enlarging the mesh size of the net basket(from 10.5 node to 10 node) and income compensation(Committee on the Introduction of New System for Resources Management in Niigata Prefecture, 2011).

However, the other production areas such as Ishikawa pref. have practiced the enlargement of the mesh size (8 node), and it brings results(Niigata Prefecture Fishery Research Institute "2012 Presentations of the research and investigation of the fisheries" 24 Jul. 2012 ).

<sup>10</sup> SEM analysis uses the GML1.71 program of Kojima (2003).

**Table 3.** Factors and Dimensions, and Variables about Change in Consumer Behavior

Factors and Dimensions		Economic Description	Settings of Variables <sup>1)</sup>	Recital
Objective Variables	Behavior	Choice Behavior	M1. Purchasing Criteria M2. Purchasing Behavior on the Unfamiliar Fresh Fishery Products	Factor Analysis(Table 7) Binary Variables(Table 9)
External Factors	Objective	Constraints (Budget, Time, Technology, Information, Physical)	L1. Socio-economic Attributes <sup>2)</sup> (Income, Residence, Sex, Age) L2. Degree of Price Consideration	Nominal Scale Scale of 1 to 5
Internal Factors	Subjective	Motivation  Preferences(taste, risk, time) Habits and Cognition	L1. Motivation behind Dietary Habit (i) Motives by Desires: Physiological-Social (ii) Social Motives: Exogenous-Endogenous L2. Fish Eating Preference L2. Consciousness of Dietary Habits (i) Interest and Activity (High-Low) (ii) Health and Nutrition Intention (High-Low)	Quantification Methods Type 3 (Table 5)  Scale of 1 to 5 Quantification Methods Type 3 (Table 4)
Social Factors	Multiple (Objective and Subjective)	(Social Capital) Social Norms	L2. Multi-functionality of Fishery (i) Economic Functions (ii) Cultural Functions (iii) Social and Environmental Functions	Quantification Methods Type 3 (Table 6)
		Network  Trust	L2. Consciousness of Dietary Habits (iii) Social Relationship Intention (High-Low)	Quantification Methods Type 3 (Table 4)

Notes: 1) L1 and L2 represent the level of causality of SEM analysis.

2) "Socioeconomic attributes" is assumed to be two factors behind variables that affect social factors and internal factors and variable factors defining the various constraints.

**Table 4.** Consciousness of Dietary Habits (Quantification Methods Type 3)(n=1,135)

	1st	2nd	3rd
Eating regularly	0.000	-0.712	-0.981
Do not skipping breakfast	0.000	-0.709	-1.602
Taking homemade meals as much as possible	0.000	-0.259	0.718
Eating with the whole family	0.000	-1.018	0.596
Enjoying conversation with people eating together	0.000	-0.369	1.705
Eating in a congenial atmosphere	0.000	0.312	2.289
Taking care of the number of items and nutritional balance	0.000	0.384	0.141
Eating a lot of vegetables	0.000	0.010	-0.326
Eating traditional food and seasonal food	0.000	0.657	0.889
Taking care of the fat, calories and salt	0.000	0.350	0.049
Using safe foodstuff	0.000	0.399	0.519
Reducing food waste and cooking lean	0.000	0.812	0.738
Supplementing with nutrients and supplements that do not take enough	0.000	5.726	-2.006
Do not paying particular attention	-8.004	0.000	0.000
Accumulated Contribution Ratio	42.9%	50.9%	58.4%
Explanation of Axes	Interest and Activity (High-Low)	Health and Nutrition Intention (High-Low)	Social Relationship Intention (High-Low)

Note: the sample that responded only "macrobiotic" and "Others" are excluded because of the difficulty of interpretation.

**Table 5.** Motivation behind Dietary Habits (Quantification Methods Type 3)(n=1,135)

	1st	2nd
Eating delicious food	1.129	-0.080
Finding out new stores	-0.023	2.121
Talking about going fashionable stores	-1.065	2.518
Sharing time with people around food	0.233	-0.224
Selecting novelty goods and high quality goods	-0.538	-0.367
Cooking a meal	-0.190	-1.163
Offer hospitality of food	-1.274	-0.813
Teaching people how to cook a meal	-2.066	-0.716
Acquiring knowledge about nutritional science and food culture, etc.	-2.084	-0.912
Knowing as much about beauty and sliming effect	-1.648	1.242
Accumulated Contribution Ratio	17.2%	31.0%
Explanation of Axes	Motives classified by Desires : Physiological -Social	Social Motives: Exogenous- Endogenous

Note: Samples which answered "others" or "There is nothing especially" only are excluded.

**Table 6.** Multi-functionality of Fishery (Quantification Methods Type 3)(n=1,135)

	1st	2nd	3rd
Stable supply of fresh food	1.482	-0.778	-0.624
Creating employment opportunities	0.736	0.344	1.659
Promoting material circulation by fishing	-0.134	-0.487	1.136
Beautifying the environment such as seashore and port	-0.554	-0.447	0.844
Planting trees for fish breeding	-1.363	-0.573	0.946
Water purification by filter feeding animal	-0.738	-0.389	-0.829
Ecological conservation through water purification of tidal land	-1.249	-0.651	-1.064
Ecological conservation through water purification of underwater forest	-1.371	-0.695	-0.967
Fishing with a fish boat helps the preservation of life and asset	-0.831	0.570	0.845
Fishing with a fish boat functions as disaster prevention and rescue	-0.870	0.848	0.396
Function of recreation, intercommunion and education	-0.273	2.112	0.346
Creation and succession of traditional culture	0.353	2.335	-1.120
Accumulated Contribution Ratio	12.5%	23.2%	32.8%
Explanation of Axes	Economic Functions	Cultural Functions	Social and Environmental Functions

Note: Samples which answered "others" or "There is nothing especially" only are excluded.

satisfaction in the daily dietary habits). According to the results, 1st axis can be interpreted as "Motives classified by Desires: Physiological -Social" and 2nd axis can be interpreted as "Social Motives: Exogenous-Endogenous"<sup>11</sup>.

### **Multi-functionality of Fishery**

Table 6 shows the results of the quantification method type 3 on the multi-functionality of fishery (do you think that what kind of functions fishery in Japan has). According to the results, 1st, 2nd and 3rd axes can be interpreted as

"Economic Functions", "Cultural Functions" and "Social and Environmental Functions" respectively.

### **Purchasing Criteria of Fishery Products**

Table 7 shows the results of the factor analysis on the purchasing criteria of fishery product<sup>12</sup>. According to the results, factors of 1, 2 and 3 can be interpreted as "Local Intention", "Convenience Intention" and "Freshness Intention".

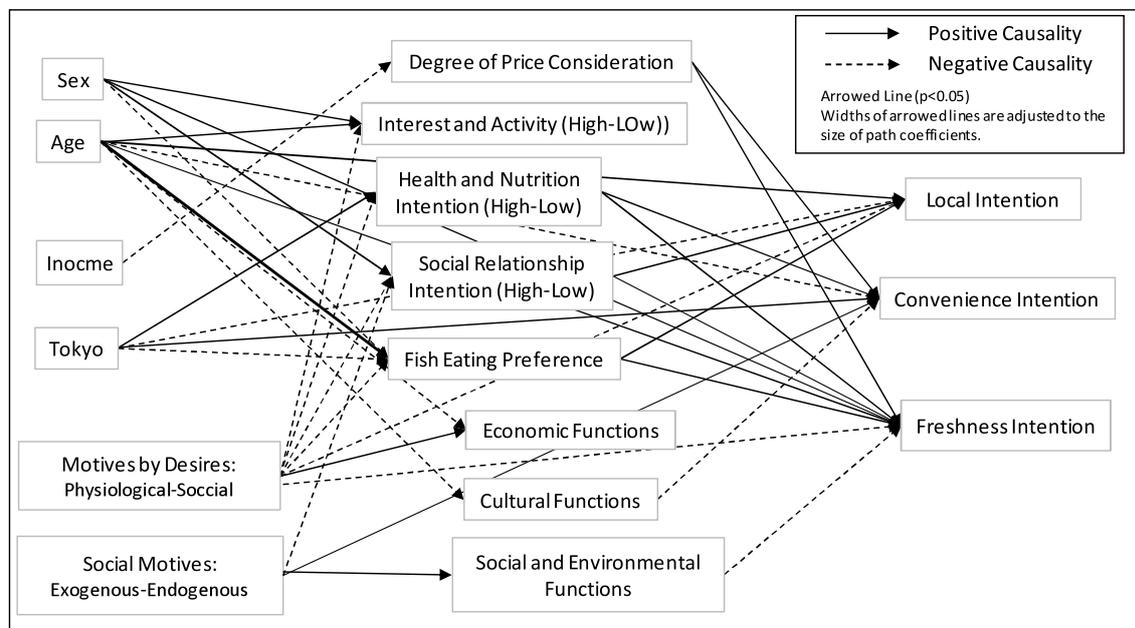
<sup>11</sup> Desires of motivations consist of primary needs (thirst, sleep, a sexual urge, etc.) and secondary needs (social fame, a status, friendship, authority, etc.). Here, motivation based on the primary needs uses as physiological motive and latter one uses as social motive. And, social motives can be classified into exogenous motives and endogenous motives.

<sup>12</sup> As for each purchasing criteria, score of 5, 4, 3, 2, 1 are given to the response items of "very important", "relatively important", "difficult to say", "not important", "not important at all" respectively. And, the criterion of price was excluded in the analysis (Ogawa, 2004).

**Table 7.** Factor Analysis on the Purchasing Criteria of Fishery products (n=1,135)

	Factor Loadings			Commonality
	Factor 1	Factor 2	Factor 3	
Freshness	0.106	-0.051	<b>0.545</b>	0.311
Eating experience	0.150	<b>0.469</b>	0.071	0.247
Nature	<b>0.497</b>	0.421	0.258	0.491
Removing head and internal organs	0.037	<b>0.519</b>	-0.004	0.271
The best season	0.438	0.182	<b>0.456</b>	0.434
Domestic products	<b>0.635</b>	0.210	0.341	0.563
Local products	<b>0.843</b>	0.122	0.128	0.742
Introduction by TV and Magazines	0.357	<b>0.438</b>	-0.185	0.354
Accumulated Contribution Ratio	21.4%	33.4%	42.7%	
Name of Factors	Local Intention	Convenience Intention	Freshness Intention	

Note: Method of factor extraction is principal factor method, rotation method is varimax rotation.



**Fig 1.** Formation Process of Consumer's Consciousness toward Aquatic products

**4.2 Results of the SEM Analysis**

Fig. 1 and Table 8 show the path coefficients and the path diagram obtained respectively from the result of SEM analysis. The result of indexes of the fitness is good (GIF=0.993, AGFI=0.984, SRMR=0.021, RMSEA=0.045). According to the results, formation process of consumers' consciousness on the purchasing criteria of fishery products can be explained that the social and economic attributes and the motives determines the dietary habit and affect three types of intentions(Local, Convenience, Freshness) to purchase fishery products. Therefore, effective measures to promote purchasing of fishery products in accordance with each type of intentions can be considered as follows.

First, "Local Intention" is affected by the "Motives classified by Desires: Physiological -Social (-)" and "Social Relationship Intention (High-Low) (+)". As for these

consumers, not novelty, but providing fishery product rooted locally is required.

Next, "Convenience Intention" is affected by the "Social Motives: Exogenous-Endogenous (+)", "Degree of Price Consideration (+)", "Economics Functions (+)", "Cultural Functions (-)" and "Social and Environmental Functions (-)". As for these consumers, the fishery products with low price, easy cooking and processed should be developed. In other words, there is a large room for expanding the consumption of fishery products for the consumers with "Convenience Intention".

Third, "Freshness Intention" is affected by "Motives classified by Desires: Physiological-Social (-)", "Health and Nutrition Intention (High-Low)(+)", "Social Relationship Intention(High-Low)(+)", "Degree of Price Consideration(+)" and "Social and Environmental Functions(-)". Therefore, the

**Table 8.** Path Coefficients(n=1,135)

No	Variables	Variables	Estimated coefficients	p-value
1	Degree of Price Consideration	(2) Income	(1) -0.089	.003 **
2	Interest and Activity (High-Low)	(2) Sex	(1) .119	.000 **
3	Interest and Activity (High-Low)	(2) Age	(1) .087	.003 **
4	Interest and Activity (High-Low)	(2) Motives by Desires (Physiological-Social)	(1) -.144	.000 **
5	Health and Nutrition Intention (High-Low)	(2) Tokyo	(1) .064	.030 *
6	Health and Nutrition Intention (High-Low)	(2) Motives by Desires (Physiological-Social)	(1) -.125	.000 **
7	Social Relationship Intention (High-Low)	(2) Sex	(1) .148	.000 **
8	Social Relationship Intention (High-Low)	(2) Motives by Desires (Physiological-Social)	(1) -.221	.000 **
9	Social Relationship Intention (High-Low)	(2) Social Motives (Exogenous-Endogenous)	(1) -.076	.007 **
10	Fish Eating Preference	(2) Sex	(1) -.153	.000 **
11	Fish Eating Preference	(2) Age	(1) .310	.000 **
12	Fish Eating Preference	(2) Tokyo	(1) -.089	.001 **
13	Fish Eating Preference	(2) Motives by Desires (Physiological-Social)	(1) -.175	.000 **
14	Economic Functions	(2) Age	(1) -.074	.009 **
15	Economic Functions	(2) Motives by Desires (Physiological-Social)	(1) .226	.000 **
16	Cultural Functions	(2) Age	(1) -.179	.000 **
17	Social and Environmental Functions	(2) Social Motives (Exogenous-Endogenous)	(1) .073	.013 *
18	Local Intention	(3) Sex	(1) -.050	.090
19	Local Intention	(3) Age	(1) .108	.000 **
20	Local Intention	(3) Tokyo	(1) -.193	.000 **
21	Local Intention	(3) Motives by Desires (Physiological-Social)	(1) -.065	.027 *
22	Local Intention	(3) Degree of Price Consideration	(2) -.038	.178
23	Local Intention	(3) Health and Nutrition Intention (High-Low)	(2) -.045	.115
24	Local Intention	(3) Social Relationship Intention (High-Low)	(2) .062	.037 *
25	Local Intention	(3) Fish Eating Preference	(2) .131	.000 **
26	Local Intention	(3) Economic Functions	(2) -.030	.293
27	Convenience Intention	(3) Sex	(1) .044	.133
28	Convenience Intention	(3) Age	(1) -.118	.000 **
29	Convenience Intention	(3) Tokyo	(1) .092	.001 **
30	Convenience Intention	(3) Social Motives (Exogenous-Endogenous)	(1) .103	.000 **
31	Convenience Intention	(3) Degree of Price Consideration	(2) .093	.001 **
32	Convenience Intention	(3) Health and Nutrition Intention (High-Low)	(2) -.049	.091
33	Convenience Intention	(3) Social Relationship Intention (High-Low)	(2) -.029	.332
34	Convenience Intention	(3) Economic Functions	(2) .038	.203
35	Convenience Intention	(3) Cultural Functions	(2) -.066	.021 *
36	Convenience Intention	(3) Social and Environmental Functions	(2) -.063	.026 *
37	Freshness Intention	(3) Sex	(1) .102	.001 **
38	Freshness Intention	(3) Age	(1) .126	.000 **
39	Freshness Intention	(3) Income	(1) .037	.180
40	Freshness Intention	(3) Motives by Desires (Physiological-Social)	(1) -.065	.030 *
41	Freshness Intention	(3) Degree of Price Consideration	(2) .148	.000 **
42	Freshness Intention	(3) Health and Nutrition Intention (High-Low)	(2) .058	.040 *
43	Freshness Intention	(3) Social Relationship Intention (High-Low)	(2) .128	.000 **
44	Freshness Intention	(3) Fish Eating Preference	(2) .104	.001 **
45	Freshness Intention	(3) Cultural Functions	(2) -.053	.060
46	Freshness Intention	(3) Social and Environmental Functions	(2) -.070	.011 *

Note: Variables of Socio-economic attributes are as follows.

Sex: Male=1, Female=2.

Age: 20's=1, 30's=2, 40's=3, 50's=4, 60's=5.

Income: 4~6 million yen =1, 6~8 million yen=2, 8~10 million yen=3, 10~12 million yen=4, 12 million yen=5.

In addition, the variable of "Degree of Price Consideration" sets the score by using the result of purchasing criteria: "very important(5)", "moderately important(4)", "neither(3)", "not moderately important(2)", "not important at all(1)".

Number shown in parentheses indicates the order of causality in the analysis.

\*\*\*\*, \*\* indicates the statistically significant at 1% and 5%.

effective measures for expanding fishery consumption to the consumers with "Freshness Intention" are considered to be the technological development in distribution for remaining freshness and the providing information on health.

### 4.3 Consumer's Consciousness and Behavior on the Unfamiliar Fresh Fishery Products

For expanding the demand for new fishery products, it is necessary to promote "unfamiliar" fresh fishery products. Here, we assume that the environments of respondents consist of (i) existence of "scientific information" and (ii) existence of "opportunities to purchase unfamiliar fresh fishery products." In the environment with purchase opportunities, the characteristics of respondents can be divided into the following two types: "those who will purchase if there is scientific information (or with an increasing possibility of purchasing)"; "those who do not purchase even if there is scientific information (or with an unchanged possibility of purchasing)."

Table 9 shows the results of the consumers' purchasing behavior of unfamiliar fresh fishery products, those who are classified into four groups according to the existences of purchasing experiences and influence of scientific information<sup>13</sup>. Group A is "those who have purchasing opportunities and purchasing experiences, and positively accept scientific information". Consumers in the group will purchase the fishery products when new fishery products and scientific information are provided (34.5% of total). Group B consists of "those who have the purchasing opportunities but the influence of scientific information are unclear" and "those who have the purchasing experiences and will purchase conditionally except for scientific information". This type of consumers will make purchase when new fishery products are provided (7.8% of total). Group C consists of "those who accept scientific information but do not have the purchasing opportunities", which means that consumers in the group will make purchase when the conditions of scientific information and purchasing opportunities are appropriate (33.8% of total). Group D is "those who do not make purchase even if the purchasing opportunities and scientific information are provided". Therefore, it is difficult to make promotion to these consumers with purchasing of unfamiliar fresh fishery products (23.9% of total).

Fig.2 and Table 10 show the results of the SEM analysis on the "purchasing behavior of unfamiliar fresh fishery products (Group A,B,C)" which replaced the variables of "purchasing criteria of fishery products". As a whole, the results of the index of fitness are good (GIF=0.989, AGFI=0.979, SRMR=0.026, RMSEA=0.018).

According to the results, the behavior of group A is determined by "Sex(-)", "Motive classified by Desires: Physiological-Social(-)" and "Health and Nutrition Intention(High-Low)(+)", and characterized by the culture and

**Table 9.** Purchasing Behavior on the Unfamiliar Fresh Fishery Products (Purchasing Experiences, Influence of the Scientific Information)

	With Purchasing Experience	Without Purchasing Experience	Total
With Influence of the Scientific Information	A: $\frac{34.5}{81.6}$	C: $\frac{33.8}{58.5}$	956
Without Influence of the Scientific Information	B: 7.8 (18.4)	D: 23.9 (41.5)	444
Total	592	808	1400

Note: Values in parentheses indicates the proportions dividend by the number of respondents of "With Purchasing Experience" and "Without Purchasing Experience" respectively.  $\chi^2 = 5.99$ , p-value=0.014.

Question of the purchasing experience: "Have you ever purchased unfamiliar fresh fishery products (multiple selection allowed)? Here 'unfamiliar' products mean the fresh fishery products which you have not purchased, not eaten and not known until then".

Question of the influence of the scientific information: "What kind of the scientific information do you need when you consider purchasing the unfamiliar fresh fishery products (multiple selection allowed)?"

process of eating. Factors affecting the behavior of group B are unknown. The behavior of Group C is determined by "Motives classified by Desires: Physiological- Social(+)" and characterized by individual rationality. Therefore, putting these facts all together, it is clarified that there is a little internal factors affecting "the purchasing behavior of unfamiliar fresh fishery products (Group A,B,C)" while social factors doesn't affect the behaviors at all.

Moreover, with regard to the types of influencing information, the number of responses is higher in descending order of "Safety", "Palatability", "Freshness", "Effect on Health"(Table 11). Those who have purchasing experiences selected more items than those who have no purchasing experiences and particularly made notes of "Palatability", "Safety" and "Freshness". Unfortunately, "Practice of fishery resource conservation" on the whole is as low as 6.6%, which shows that the information of resource conservation is not sufficiently appealed to the consumers.

### 4.4 Conditions for the Promotion of Consumption on Fresh Fishery Products

Table 12 summarized the results of the responses about the conditions for the consumption on fresh fishery products (multiple selections). All in all, high ratios of the responses are

<sup>13</sup> As for the "others" in the sample group of "with purchasing experience", 1 sample that answered the "it doesn't know" is treated as "without purchasing experience".

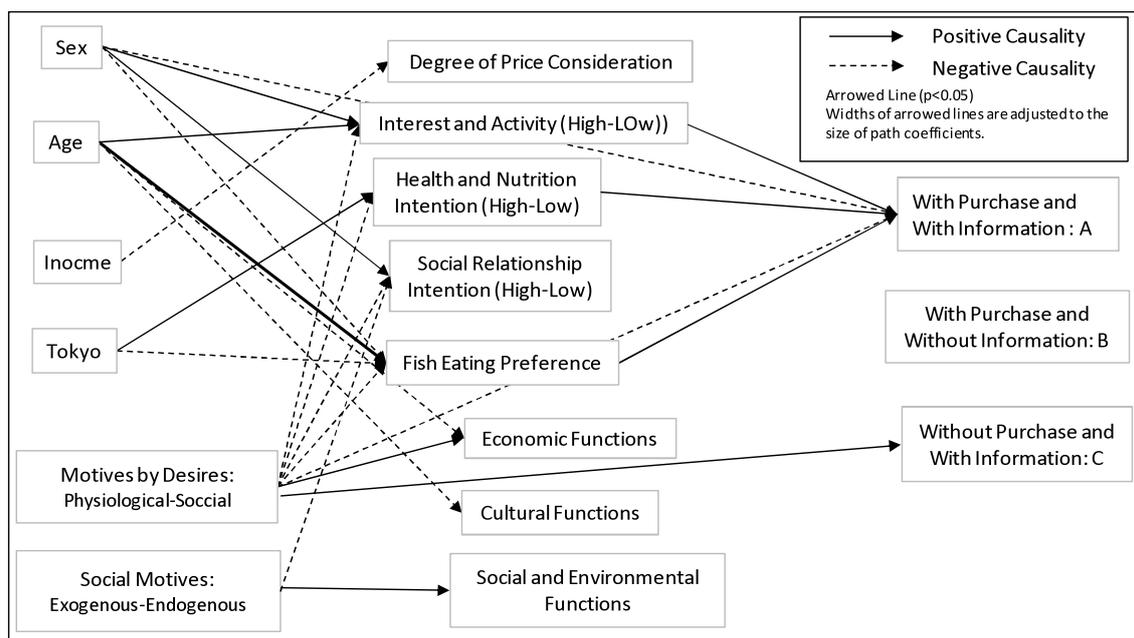


Fig 2. Formation Process of Consumer's Consciousness toward the Unfamiliar Fresh Fishery Products

Table 10. SEM Analysis on the Consumer's Consciousness of the Unfamiliar Fresh Fishery Products(n=1,135)

No	Variables	Variables	Estimated coefficients	p-value
18	With Purchase and With Information: A	(3) Sex	(1) -.060	.005 **
19	With Purchase and With Information: A	(3) Age	(1) -.018	.523
20	With Purchase and With Information: A	(3) Motives by Desires (Physiological-Social)	(1) -.273	.000 **
21	With Purchase and With Information: A	(3) Degree of Price Consideration	(2) -.011	.616
22	With Purchase and With Information: A	(3) Interest and Activity (High-Low)	(2) .057	.042 *
23	With Purchase and With Information: A	(3) Health and Nutrition Intention (High-Low)	(2) .072	.011 *
24	With Purchase and With Information: A	(3) Social Relationship Intention (High-Low)	(2) .036	.213
25	With Purchase and With Information: A	(3) Fish Eating Preference	(2) .052	.018 *
26	With Purchase and With Information: A	(3) Social and Environmental Functions	(2) .028	.172
27	With Purchase and Without Information: B	(3) Motives by Desires (Physiological-Social)	(1) .007	.816
28	With Purchase and Without Information: B	(3) Degree of Price Consideration	(2) -.036	.214
29	With Purchase and Without Information: B	(3) Health and Nutrition Intention (High-Low)	(2) .029	.327
30	With Purchase and Without Information: B	(3) Social Relationship Intention (High-Low)	(2) .042	.166
31	Without Purchase and With Information: C	(3) Age	(1) -.026	.379
32	Without Purchase and With Information: C	(3) Motives by Desires (Physiological-Social)	(1) .134	.000 **
33	Without Purchase and With Information: C	(3) Interest and Activity (High-Low)	(2) .041	.162
34	Without Purchase and With Information: C	(3) Health and Nutrition Intention (High-Low)	(2) -.031	.300
35	Without Purchase and With Information: C	(3) Social Relationship Intention (High-Low)	(2) -.002	.959
36	Without Purchase and With Information: C	(3) Economic Functions	(2) -.041	.065

Note: Number shown in parentheses indicates the order of causality in the analysis.

“\*\*\*”, “\*” indicates the statistically significant at 1% and 5%.

It only shows the path coefficients about the purchasing behavior on the unfamiliar products.

Causality order (3) used the variable of “Without Purchase and Without Information” as a reference.

**Table 11.** Scientific Information that influence consumer's decision making of purchasing the unfamiliar fresh fishery products (Multiple selection allowed, n=1,400, unit:%)

	Freshness	Palatability	Practice of fishery resource conservations	Safety	Effect on Health	Production Area	Others	It does not influence the decision
Total	33.2	37.4	6.6	39.4	27.8	17.4	0.9	31.7
With Purchasing Experience	41.6	45.4	10.1	44.6	31.3	21.1	1.2	18.4
Without Purchasing Experience	27.1	31.6	4.1	35.5	25.2	14.7	0.6	41.5
p-value(two-sided)	0.000	0.000	0.000	0.001	0.013	0.002	0.258	0.000

Note: p-value indicates the result of 2-sample test.

**Table 12.** Conditions for Promotion of Consumption on Fresh Fishery product Products (Multiple Selections, n=1400, Unit: %)

		Total	Fish Eating Preference				
			5	4	3	2	1
1	Sending products directly to the daily use retail stores from the production area	69.4	3.7	5.9 *	▲ 0.2	▲ 4.5 *	▲ 5.5
2	Sending products door-to-door	14.2	4.9	0.5	▲ 0.6	▲ 1.1	▲ 3.1
3	Purchasing products at direct sale stores in the production area	26.1	9.9 **	3.4	▲ 1.1	▲ 2.2	▲ 16.3 **
4	Branding by the organization of the production area	13.3	5.9 *	2.6	▲ 1.1	▲ 1.5	▲ 7.7 *
5	Quality assurance by the third-party institution	15.6	0.5	1.0	3.4 **	▲ 4.1 **	▲ 5.9
6	Eating at the belt-conveyor sushi	26.7	▲ 1.0	▲ 2.4	1.5	▲ 0.3	2.5
7	Eating at the sushi stores(except for belt-conveyor sushi)	11.5	3.5	▲ 1.9	1.5	▲ 1.5	▲ 3.2
8	Eating takeout sushi and lunch bags	11.9	2.5	0.7	0.1	▲ 1.9	0.6
9	It is not high price	57.9	▲ 5.2	▲ 4.4	3.3	0.5	3.2
10	Others	2.3	0.1	▲ 0.8	▲ 0.3	0.5	1.9
	Average number of selected items(1-10)	2.5	2.7	2.5	2.6	2.3	2.2

Note: “\*\*” and “\*” indicate statistically significant at 1% and 5% level respectively by the 2-sample test.

Values by “Fish Eating Preference” are the difference values between the total values and the each of the values.

“Sending products directly to the daily use of retail stores from production area”, “It is not high price” and “Eating at the belt-conveyor sushi.” Therefore, improvement in the accessibility to the purchase of products is the most important condition. On the other hand, for the consumers with high preferences of fish eating, the ratios of responses of “Purchasing products at direct sale stores in the production area” and “Branding by the organization of the production area” are similarly high. This means that when the production area and the distribution sector cooperate with each other, the consumers who have already had a high level of fishery consumption might increase their consumption further. However, for the consumers who have a low level of fish eating preference due to “physical constraints” which

means a lack of the accessibility to fresh fishery products in addition to the constraints of income and cooking skills<sup>14</sup>, the increase in the consumption of fresh fishery products is considered to be partly achieved through acquiring cooking skills and the improvement of distribution systems.

## 5. CONCLUSIONS

In this paper, we tried to clarify the formation process of consumer's consciousness about the fishery products by applying the SEM analysis on the results of the questionnaire survey. Following findings are obtained.

First, it is clarified that consumer's purchase standard over fishery products have three intentions; 'local intention',

<sup>14</sup> As a dissatisfied factor about the fishery products, ratio of responses is higher in the descending order of “price is high (40.7%)”, “food preparation method not being learned (32.4%)”, and “there a few repertoires of cooking (28.9%)”.

'convenience intention', and 'freshness intention.' And as for the formation process of the consciousness, the socio-economic attributes and the motives for consumption have determined fish-eating behavior.

Second, it became clear that offering products with the scientific information about 'taste', 'safety', 'freshness', etc. is important for the purchase of 'unfamiliar' fresh fishery products. Moreover, improvement of the consumer's recognition that the consumption rise of unfamiliar fresh fishery products contributes to fishery resource conservation is also important<sup>15</sup>.

Third, increase in the consumption of a new variety of fishery products is necessary to be carried out through the improvement of cooking skills and distribution system.

Therefore, in order to construct a sustainable food system for aquatic products from economical, environmental and social aspects, attentions on consumer's consciousness and behavior toward fisheries and its products should be taken into account in the policy while it corrects the mismatch and the asymmetry of information between fishery operators and consumers. Specifically, it is important to provide consumers incentives to purchase the products through the followings: (i) Improving the freshness maintenance technology and constructing the distribution system; (ii) Presenting the scientific information of the resource conservation and quality enhancement; (iii) Creating the opportunities harmonizing the intrinsic motivation of consumers. Moreover, in a medium-and-long term perspective, the introduction of ITQ system corresponding to fish species and the fishing method should be seriously taken into account.

For that purpose, designing and introducing the policy and institution which provide fishery operators with motives to take voluntary cooperative action for resource conservation and make efforts for improving a long term fishery management are crucial, in addition to the cooperation among entities (government, fishery operators, production area, distributors, retailers and consumers etc.).

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<sup>15</sup> As for the recognition of Eco-label fishery product (MSC, MEL) in the questionnaire (Did you know about the Eco-label fish products?), ratio of responses are "not have known and seen it(90.1%)", "have seen it(3.4%)", "have known the name(3.1%)", "have known the meaning(1.9%)", "have purchased it(1.5%)". Low level of recognition (10%of total) to the Eco-label in "fishing-resources protection" indicates the importance of the education in this field.

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## 水産物に対する消費者意識の影響要因に関する分析

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### 要約

日本では、寒流と暖流が交差する周辺海域に多様な海洋生物が生息し、漁獲・食用される魚介類の種類が豊富であることを背景に、魚介類がタンパク源として消費される長い歴史を有している。しかしながら、近年は魚介類の消費量の減少とともに特定魚種への集中化も進んでいる。一方、日本の近海において乱獲による良質な漁業資源の減少が魚介類の価格低迷の要因となり、漁業者の経営を悪化させることが懸念されている。持続可能な水産業の発展を実現させるためには、漁業資源の保護と健全な利用の両立が求められており、消費者側からの支えも重要であると考えられる。すなわち、制度の設計には新たな水産物需要の開発による消費拡大策も含む必要がある。

そこで、本研究では、消費者の水産物に対する意識と行動、およびそれらに影響する要因を分析することを通じて持続可能な水産業の発展および水産物を巡るフードシステムの構築に資する政策課題を明らかにすることを目的とする。研究方法としては、産地と消費地（北陸3県と東京都）の消費者層を対象に、大規模なアンケート調査を実施し、そこから得られた結果に共分散構造分析を適用し、水産物に対する消費者の意識構造を明らかにした。

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