Pearl Standard　2020

New edition

Japan Pearl Promotion Society

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I Purpose of the Standard

The origin of the global pearl culturing industry began with the manufacturing of hemispherical cultured pearls by Kokichi Mikimoto in 1893. In 1907, Tokichi Nishikawa invented a technique for the production of whole, round cultured pearls known as the 'piece method'. This discovery has been handed down relatively unchanged from this original technique as a key technology for culturing pearls globally today. Over the years, Japanese cultured pearls have had a major influence on jewelry trends and fashion styles across the world. To acknowledge Japan's historic position in the global pearl industry, "Pearl Promotion Law" was introduced in 2016.

In line with this, the Pearl Standard will explain the criteria to preserve the quality and market value of cultured pearls, as well as the jewelry created from them. To assure the success of these standards will require mutual recognition by members of the international industry – from cultivators, manufacturers, distributers and consumers, as well as those in related sectors – of the importance of maintaining the quality of pearls, and the techniques for culturing them which were established in Japan.

The Pearl Standard will explain the historical origins of cultured pearls, clarify associated terminology, and outline the criteria required to uphold the market value, standards of processing and treatment, inspections, and legislation concerning their production, manufacture and distribution,

Ⅱ　The Pearl's Charter

THE PEARL'S CHARTER

Established in 1993 (5th Year of Heisei)
Revised in 2019 (1st Year of Reiwa)
Established by Japan Pearl Promotion Society

Pearls, created by nature, are living jewels which have been enjoyed for centuries for their intrinsic beauty.

We have endeavored to enhance the natural beauty of cultured pearls through our commitment to improved techniques, while not affecting nature's work.

Pearls are now produced on a worldwide scale. This is a development which enhances their universal acceptance.

It is our wish that pearls may enrich our daily lives and play an important part as a messenger of peace in the long run.

A pearl is a prayer for the quintessence of beauty that is created by nature and man. As pearl cultivating pioneers and industrialists, it is our intention to promote and safeguard the mystical quality of pearls making effective use of our experience and ability.

Ⅲ Principles of the Pearl Standard

Japan Pearl Promotion Society's 1993 "Pearl's Charter" articulates the principles and values for the production, distribution and acquisition of cultured pearls as established by the industry's founders. The Pearl's Charter has since provided a guiding philosophy for the execution of industry best-practice. This section will now provide an update to these principles, adapting them for present circumstances, whilst maintaining continuity with the universal values established by the Charter more than twenty-five years ago.

Japan Pearl Promotion Society strives towards the global adoption of these standards to maintain the commercial and aesthetic value of cultured pearls and ensure the sustainability of the processes involved in their production, as well as jewelry created from them. The execution principles for maintaining these standards are as follows:

1. All involved in the pearl industry should aim to undertake all their activities in line with UN Sustainability Development Goals (SDGs) to guarantee a long-term future for the cultured pearl industry which has a history over 100 years.

2. Those involved in farming cultured pearls should appreciate their historic, cultural and natural significance of pearls, jewels produced by chance through human intervention with nature. As such, they should do their utmost to guarantee the conservation of the sea, which provides the nourishing natural resources to cultivate pearls. They should also use pearl culturing techniques backed by the latest scientific knowledge, technology and expertise, and should recruit and train talented staff to provide future successors equipped to tackle the challenges of balancing stable production with variable market demands.

3. Those involved in processing and treating cultured pearls should endeavor to bring out the original, latent beauty of pearls by reducing the number of treatments and selecting techniques that will preserve pearl's natural beauty for a long time. Where processing or treatments are required, they should always disclose this information to retailers and customers. They should also make efforts to apply a common standard for correctly identifying and defining the beauty and value of pearls, since all possess varying degrees of quality.

4. Those involved in jewelry manufacture should aspire to use the skills of talented designers who can showcase cultured pearls as fashionable and desirable attributes in people's lives. They should aim to enhance the existing beauty of pearls, coordinating them with other materials which create jewelry pieces finished to a high standard that are tailored to suit the different categories of customer.

5. Those involved in the sale of cultured pearls should have completed a good level of education and training to both apprehend and convey accurate information about the beauty, quality and value of pearls. They should acquire an appreciation of the different customs and use of pearls by people all over the world and supply this diverse clientele with sincere and correct information about pearls and their associated products.

6. Those involved in appraisal and valuation of pearls should have a sound grasp of the historical background of the industry and maintain an up to date knowledge of the latest processing and treating techniques for pearls. This knowledge should be used to accurately assess the type and quality of pearls, and detect the use of processing and treatments, including their methods and extent to which they accord with domestic and/or global standards. They should provide an honest account of this assessment to ensure continued confidence of the consumer in pearl products.

7. Those who own, wear or gain enjoyment from the use of pearls and pearl jewelry, should acquire a good understanding of the pearl industry and its associated jewelry, and use the knowledge they have about pearls to drive the standards of work for those employed in the industry. In addition, consumers should seek to properly understand the quality of pearls so that they can make their own assessment by requesting the correct information from businessmen (salesmen and expert appraisers), which will monitor and improve the work of members of the pearl industry.

8. Those involved in the retail business of pearls should provide opportunities for customers to choose pearls and pearl jewelry based on accurate information about the origin of, and techniques used in its production, as well as the latest fashion trends. They should also promote a deeper understanding of the pearl to their clients, including information about the domestic and overseas supply, providing guidance

and advice based on recommendations in the Pearl Promotion Law.

9. Those involved in operations management should have a good understanding of the tasks involved in all stages of the pearl industry to fulfil the basic tenets of the Pearl Promotion Law and assist in making high-quality pearls for the international market. They should strive to teach, nurture, advise and provide support to further expand across the world the cultured pearl industry, which first originated in Japan.

Ⅳ Key Information for the Pearl Standard

Chapter 1 Defining pearls

1. Definition of a pearl

A 'pearl' is defined by the following five characteristics.

① It is formed in the nacreous body of an oyster
② It involves the creation of a 'pearl sac'
③ A biomineral pearl is formed in the sac
④ The whole surface of the pearl is formed from the same nacre as the shell of pearl oysters (nacre is defined as a stratified structure formed from a mixture of calcium carbonate crystal called 'aragonite' and an organic matrix called 'conchiolin')
⑤ It has jewelry value.

The criteria from ① to ④ are based on the processes by which a pearl forms, whereas criteria ⑤ is based on the resulting value of a pearl.

1.1 Characteristics of pearl formation

① It is formed in the nacreous body of an oyster

The advanced tissue culturing techniques developed for vertebrates, such as human beings, cannot be applied to invertebrates such as oysters. Therefore, it is impossible to artificially synthesize biomineral pearls by culturing cells in this way from the mantle tissue of an oyster. However, as the detrimental impact of synthetic diamonds to the market has shown, we cannot rule out that it may be possible in the future to artificially synthesize pearls.

As there has been an increase over the years in the production of fake pearls, made in factories or laboratories, it is important to clarify the definition of pearls in support of criteria ①

"A pearl is a substance made by an oyster in the natural sea".

To preserve the value of pearls, it is important to differentiate between pearls that are nurtured in the natural environment, and those that are produced from artificial substances.

② It involves the creation of a 'pearl sac'

③ A biomineral pearl is formed in the pearl sac

There is evidence that research on pearls and their production from oysters was started early as 16th to early 18th century in Europe. At that time, it was observed that pearls and oyster shells are made from the same substance. In 1856, Theodor von Hessling of Germany discovered by his detailed histological observation that when an external stimulus causes the epithelial tissue of the mantle to intrude into the body of an oyster, it forms a cyst within which a pearl is formed. The cyst that Hessling discovered was later named "Sac de la perle" in 1899 by Leon Diguet of France. It was so named after it was shown that pearls are made inside this sac, which is composed from the same cells as that of the mantle. A cultured pearl therefore is a pearl formed in pearl sac that has been artificially stimulated to form inside an oyster's body.

The history of the cultured pearl industry began with Kokichi Mikimoto, whose ambition to produce jewel-quality pearls using Akoya oysters, led to his first meeting with Dr. Kakichi Mitsukuri of Tokyo Imperial University. Dr. Mitsukuri's knowledge and research on pearls firmly convinced Mikimoto that making pearls through human intervention was possible. In 1907 three Japanese, Kokichi Mikimoto, Tokichi Nishikawa and Tatuhei Mise established their own techniques to form a spherical pearl in an oyster body, and Mikimoto paved the way for a new spherical pearl culturing industry.

Criteria ② and ③ are based on the scientific and historical characteristics of pearl culturing.

④ The whole surface of a pearl is formed from the same nacre as the shell of pearl oysters

In 1919, when Kokichi Mikimoto started to sell his cultured pearls in Europe, jewelers in Paris who were at that time trading in natural pearls, boycotted cultured pearls to stop their influx into the pearl market. Mikimoto subsequently filed a lawsuit against this movement. Through a close inspection of cultured pearls by leading scientific experts in the pearl industry at the time, it was declared that cultured pearls were in fact real pearls. After the verdict of September 20, 1924, a statement was released that "Japanese

pearls should be recognized as high quality pearls made from nacre, with a nacreous nucleus inside them". It was concluded that cultured pearls are thus true pearls because they are constructed from the same nacre as natural pearls.

Criteria ④ is therefore supported by the definition resulting from the outcome of the Paris court trial which concluded that "cultured pearls are real pearls as they have the same nacre of natural pearls". At that time, it was also shown that the nuclei were made from nacreous material.

For further details, see Chapter 2 The history of pearl culturing.

There are some examples of pearls that do not correspond with the above characteristics but have historically and exceptionally been treated as pearls because of their jewelry value. These examples are biominerals produced in mollusks that do not have nacreous structured in their shells, such as Queen Conch *(Lobatus gigas)*, Horse conch *(Triplofusus gigantea)*, Melo (*Melo* sp) and Hardclams (*Mercenaria mercenaria*). Also blisters having the requisite worthy of jewels are thus excepted from the definition provided in ① - ④, since they have historically been treated as pearls.

1.2 Assessing the jewelry value of pearls

As criteria ⑤ It has jewelry value indicates, it is important to consider the criteria that make pearls jewels, as well as their processes of formation. We have to decide therefore what characteristics give peals value as jewels, by considering three factors: beauty, durability and rarity.

(1) Beauty

Beauty of a pearl depends on its characteristics, such as shape, nacre thickness, extent of flaws, its luster and color. In addition, smoothness transparency and evidence of blemishes on the surface are important considerations. The beauty of a pearl on the whole is judged by a qualitative assessment of the relative beauty of each of these aspects. In this respect, the evaluation of pearls is rather different from other gemstones. In order to improve the beauty of pearls, diligence is needed throughout all stages from supplying high-quality raw materials (pearl oysters and nuclei) through to their production, processing and distribution.

(2) Durability

The characteristics of pearls greatly differ from those of other gemstones, which are typically composed of wholly inorganic substances. A pearl is composed of a stratified structure called nacre that consists of thousands of inorganic calcium crystals called aragonite and an organic matrix called conchiolin piled together. The durability of a pearl is determined by the thickness of its nacre. The thicker nacre becomes, the more durable a pearl is. However, not only thickness, but also other characteristics of nacre are important, such as its nature, shape, uniformity of layers of calcium carbonate crystals and the strength of its organic matrix. The durability of a pearl decreases when different calcium carbonate crystals called calcite and other foreign substances are present in the nacre. The thickness of nacre is determined during the production stages of pearl culturing, but the degree of damage to the organic matrix varies according to any subsequent treatments it undergoes, as well as how well it is stored and handled afterwards.

For these reasons, the durability of pearls can be evaluated by nacre thickness and the degree of injuries to their organic matrix. For example, there are occasions where a pearl may have extremely thin nacre which gradually by deterioration and abrasion of the surface, exposes the nucleus. As a result, its jewelry value can be rapidly lost in a short period of time. Another example involves deterioration of the organic matrix (conchiolin), which decreases the latter's adhesive power, causing the nacre of a pearl to peel off. In addition, extreme damage to the organic matrix can be caused by ultraviolet light, heat and excessive physical and chemical treatments. The durability of a pearl therefore depends on maintaining adequate nacre thickness during the stages of culturing and preventing the organic matrix from being damaged after it is harvested.

(3) Rarity

It is often said that natural pearls are rarer then cultured pearls, since they result from chance finds. However, low availability does not necessarily translate to rarity value. When we see beautiful Conch natural pearls, we can appreciate that they are rare as no other mollusks yield them, thus rarity value increases. However, natural pearls from clams and oysters do not possess as high a rarity value, even though they are rare.

In the case of cultured pearls, those which are yellow in color were once not so highly evaluated. However, due to improvements in culturing techniques, the appearance of yellowish pearls has gradually been controlled. As a result, rarity value of golden

cultured pearls has increased in recent years. Unlike natural pearls, the rarity value of cultured pearls can be easily lost if we artificially produce as many as the same type as possible. When production exceeds demand, the flood of low quality pearls into the market can damage the rarity, and thus value of cultured pearls. In order to maintain the rarity and value of cultured pearls therefore, it is important to continue our efforts to raise the overall quality standards of pearls and eliminate low quality pearls from the market.

Determining the jewel value of pearls can be summarized in the table below.

	Beauty	**Durability**	**Rarity**
Characteristics	Shape, nacre thickness flaws, color, luster	Nacre thickness, structural soundness of organic matrix (conchiolin)	Overall ratio of high to low quality pearls produced
Improvement measures	Production to enhance quality, orientation towards nacre thickness	Treatments, stability	Maintaining a sustainable production rate

Chapter 2　The history of pearl culturing

This chapter describes the invention of cultured pearls, and the history and growth of the cultured pearl industry.

1. Research on pearl formation and pearl culturing trials

1.1 Research on pearl formation

For thousands of years, natural pearls have been highly praised in culture around the world as rare and beautiful chance finds from mollusks. The fashion for being adored by precious, lustrous pearls was a practice enjoyed by an elite, privileged few.[1,2]

Throughout history, people were fascinated with the mysterious origins of pearls, and thus invented many stories for how pearls are born. The Roman naturalist and philosopher of the first century B.C, Pliny the Elder (Gaius Plinius Secundus), stated in his opus, *Naturalis Historia,* that "pearls are formed from drop of dew". This theory was widely believed until the 11th century or so, when the notion that a pearl is born from a seed conceived in a mollusk's body by a natural accident became popular. However, the precise cause of a pearl's formation was still shrouded in mystery.[3]

Through the development of modern science from the middle of the 16th century, the imaginative theories for the causation of pearls were gradually debunked. People interested in pearls tried to make them by their own hands with a scientific spirit of inquiry. They began research to prove the secret of the pearl's origins, and from the 18th century to the beginning of the 20th century, pearl formation was a topic enthusiastically studied in Europe. Based on this body of research, from the end of the 19th century to the beginning of the 20th century, many attempts in different corners of the globe have been made to generate a pearl culturing industry.[4]

1.2 Research on pearl formation in Europe

To explain the origins of pearls in the latter 16th up to the 17th century, 'disease causation', 'egg causation' and 'sand causation' were popular theories proposed. As a result of these new directions in thought, the 'dew causation theory' which had been widely believed up to that point was completely disproved.[1-5] In the 18th century, Réaumur (R. A. de

Réaumur) of France proposed a theory that provided an early precursor to the modern scientific understanding of pearl causation. He hypothesized that a pearl was formed from a mass of materials secreted in the oyster's body when the shell-producing mantle tissue was damaged by intrusion of foreign matter or some outer force.[6]

The most important development for elucidating the cause of pearls was the discovery of the pearl sac. In the middle of the 19th century, T. von Hessling of Germany discovered through histological observation that an external force can cause the epithelial cells of the mantle to intrude into the oyster's body to form a cyst, and this is the cyst in which pearl is formed. The cyst that Hessling discovered was later named the 'sac de la perle' (pearl sac) by L. Diguet of France, who pointed out that the pearl is formed in the cyst (pearl sac) which consists of the same cells as that of the mantle.[7-9] After that time, many researchers noticed that the pearl sac is closely related to pearl formation and the discussion as to how pearl sacs formed became the center of these inquiries.

At the beginning of the 20th century, H. L. Jameson of England and L. Boutan of France reported that pearls are formed in pearl sacs, but they believed that the formation of the sac itself had something to do with parasites.[10,11] Though admitting that parasites may have a role, many researchers, through further investigations, began to notice that parasites are not the only cause for pearl formation.[12-15] In 1911, A. Rubbel of Germany rejected the earlier parasite causation theory, insisting that pearls are formed in an oyster's body when a part of the epithelial cells of the mantle covers an intrusive foreign body.[16] In 1912, Jameson reached the same conclusion.[17]

A common consensus amongst researchers from the beginning of the 20th century was that the important thing for pearl formation was not the exact nature of the substance which forms the nucleus, but the fact that an external intrusion causes epithelial tissue to fall onto the biological tissue causing the oysters to construct a pearl sac. In 1913, F. Alverdes of Germany succeeded in producing a pearl by his experiments using freshwater mussels (*Margaritifera margaritifera*).[18]The discussion thus concluded that "the formation of the pearl sac is crucial, whilst the nucleus – an external substance around which a pearl forms – is but only one aspect that causes a pearl to form". In Japan, however, the reasons for pearl causation had already been identified by 1907, and subsequently the gateway to industrialization of cultured pearls was opened.

1.3 Pearl culturing trials

For hundreds of years, people have desired to make pearls by human hands. In China, from the 11th to 13th century A.D, the technique to produce hemispherical cultured blisters and Buddha-shaped cultured pearls (cultured blisters) using freshwater mussels had already been developed. At a later time, cultured blisters came to be sold as ornaments and talismans or souvenirs with shell attached to them. Such products, however, were far from the jewelry we associate with pearls today.

Later, trials to culture pearls were frequently made in Europe. The Swedish scientist C. von Linnaeus, experimented with producing pearls by drilling a hole through the shell of a freshwater mussel, and inserting a small ball made of limestone between the shell and mantle with a silver wire, which succeeded in making a pearl by manmade intervention.[2] From the 19th to the beginning of the 20th century, many attempts were made to manufacture pearls at an industrial level. At that time the main techniques for forming pearls consisted of two methods: to insert a globular nucleus through a hole drilled in the shell, and to form a pearl by infecting it with a parasite.

In 1825, J. E. Gray expanded Linnaeus' method by announcing that pearls could be artificially made by inserting a piece of nacre between the shell and the mantle. In 1838, J. Wall's attempt to make a peal following Gray's method ended in faiure.[19] Attempts to insert a small ball into the space between the shell and the mantle to make a blister were made by G. Bouchon-Brandely in 1884 in French Polynesian Tahiti by using Black-lipped oysters, and by L. Boutan of France by using abalone off the coast of California. Although these trials reported successful experiments, none of them had yet to achieve industrial levels of production.[20-22]

Trials to set up companies raising pearl oysters and culturing pearls were made in many places of the world. William Saville-Kent, who had conducted experiments in the Torres Strait, succeeded in making hemispherical pearls, and set up a company in 1906 with plans to culture pearls further. However, in 1908 he died, and his enterprise ended suddenly. Regrettably, the technique he used to produce cultured pearls are unclear due to the paucity of records describing his methods.[23]

In 1909, J. Clark tried to culture pearls in Australia using Silver-lipped and Black-lipped oysters. During this same period, many trials for culturing pearls were conducted: by G. J. Vives of the USA near La Paz in Mexico using Black-lipped oyster and abalone, by A.

Seale using Silver-lipped oyster from the Sule Archipelago in the Philippines, and by T. Haynes in Monte Bello Island, Western Australia using Shark Bay oyster (*Pinctada albina*)[2,13]. Around 1909, J. I. Solomon of the USA succeeded in culturing hemispherical pearls using Silver-lipped oysters from Mergui Island. He sold them in London and New York between 1911 and 1912, but his business was discontinued after that time.[20]

From the end of the 19th century to the beginning of the 20th century, many trials to culture pearl were made across the world. All of them were challenged not only to cultured pearls at an experimental level, but to achieve an industrial level of cultured pearls at the entrepreneurial level. All these trials, however, did not develop the same level of industry to culture pearls for jewelry as Japan did.[24]

2. The history of pearl culturing in Japan

2.1 Trials and industrialization of cultured pearls

In Japan, natural pearl have been collected from Akoya oysters and abalone throughout time, and highly prized as jewels. In the Meiji era, natural pearls were treasures to be traded at a higher price compared with other exported marine products. As a result, the number of Akoya oysters decreased due to overfishing, causing the number of natural pearls to decrease sharply. In Ago Bay, which is situated in Ise-Shima of Mie prefecture in Japan, natural pearl collection was a major concern as it decimated the population of Akoya oysters.

Kokichi Mikimoto, handling natural pearls, started his experiments on 11 September 1888, breeding Akoya oysters near Benten Island in Shinmeimura, Ago Bay. In 1889, through an introduction by Naraetsu Yanagi, he met Dr. Kakichi Mitsukuri of Tokyo Imperial University (the first Director of Misaki Marine Biological Station) who was well informed about pearl culture study. Mikimoto was given examples of research and instructions on pearl causation, as well as case studies of attempts to culture pearls in Europe.

With advice from Dr. Kishinoue (Professor of Tokyo Imperial University) and other researchers, the collaborative efforts of Kokichi Mikimoto and Kakichi Mitsukuri paved the way for the development of culturing techniques and the improvement of research which would lead to the industrialization of the pearl industry in Japan. Receiving

instructions from Mitsukuri and others, Mikimoto was convinced that it was possible to culture pearls, and so he set about undertaking pearl culturing experiments in the following year, 1890, in the inner part of Ago Bay.

Embracing his ambition to make pearls with his own hands, Mikimoto challenged the limits of pearl culturing with experiments which inserted different foreign substances into an oyster's body, frequently changing the place for insertion through trial and error. Although the oysters he used for his experiments were decimated by a red tide which occurred in November 1892, another experiment in the seas around Ojima (present day Mikimoto Pearl Island) escaped from calamity. On July 11, 1893, he found five blisters (at that time Mikimoto called these half-pearls) attached to the inner shells of his oysters. Mikimoto examined how these pearls were made, and established a technique to culture half-pearls, patenting the technique (Patent No.2670 'Method for pearl formation'). Taking advantage of this development, he expanded industrialization and set up a pearl farm on Tatoku Island in Ago Bay on October 26, 1899. Advancing this technique, he improved production enough to succeed in the mass production of half-pearls. He used his cultured half-pearls to create jewelry, and in 1899 he sold half-pearl ornaments for the first time, rapidly expanding his business.

2.2 Development of spherical pearl culturing techniques

In the year 1907, three Japanese men, Kokichi Mikimoto, Tokichi Nishikawa and Tatsuhei Mise applied for patents for a technique to produce spherical pearls.* They are thus called the inventors of the spherical pearl, and the Japanese pearl industry views this year as the founding year for spherical pearl invention.[25] These patents prove that Japan had identified the cause for pearl formation and developed practical techniques for spherical pearl production ahead of Europe.

At the time or trial and error experiments with spherical pearl culturing at Mikimoto's pearl farm, a red tide occurred on January 10, 1905, which continued for three months resulting in 850,000 oysters, four fifth of his total stock to die. However, five pearls, with their surface entirely covered in nacre, were accidentally found among the surviving oysters operated on that year. As proof of his success, Mikimoto devised a spherical pearl forming method, a technique which he used from 1905 to 1907 to harvest pearls in the winter of 1907. Among the harvest, he chose good quality pearls to present to the Emperor Meiji. His technique involved using a spatula-like instrument, pressing the

mantle gently to form a sac into which a nucleus was inserted. He applied for a patent for this method in 1907, and Patent No. 13673 'Method for pearl formation' was granted in the next year, 1908. As this method was invented in the 38th year of Emperor Meiji's reign (1905), it was called the '38 method' or 'Meiji method'. The yield of pearls by this method, however, was extremely poor.

During this period, Mikimoto invited former dentist Otokichi Kuwabara in 1902 to tackle the development of full-scale pearl culturing. He improved the tools for inserting the nucleus into an oyster by modifying dental instruments, such as adapting a forceps clamp into a shell opening tool, which is used even today.[26] Based on a pearl forming method developed in 1914 called the 'Taisho method' (Patent No. 29429), Mikimoto devised another similar method in 1917 to insert a round shape bead made of shell, completely wrapped in mantle tissue into the body (gonad) of another pearl oyster. He applied for and was granted a patent 'Method pf pearl formation' (Patent No. 33640) for this technique in 1918, which is commonly referred to as the 'Wrapping method'. Although this method yielded good quality pearls, the efficiency of this method was poor as it involved extremely intricate and time-consuming labor.

At first, the 'Wrapping method' was treated with caution due to several technical difficulties. To investigate the robustness of this method, the Imperial Association of Inventions sent five Association members, including Chujiro Sasaki, to visit Mikimoto in May 1926 to investigate his cultured pearls. This action reflected the continuing doubt and suspicion attached to cultured pearls, even though the outcome of the Paris trials in 1924 had concluded that there was no difference between natural and cultured pearls, (see Chapter 2, 3. Early development of the cultured pearl market). The Imperial Association of Inventions thus decided to visit Mikimoto's pearl farm to assess how he was able to culture pearls by such an elaborate technique as the 'Wrapping method'. According to a report by the Association, the survey conducted by Professors of Tokyo Imperial University, Chujiro Sasaki, Kamakichi Kishinoue, Seitaro Goto and others, appraised the technique as a legitimate invention for global application.

The report states as follows[27]:

"When this method was published by the Patent Office with Patent No.33640, it was believed, at least by some Japanese that the technique of the tying the mouth of the bag formed by the mantle parenchyma would be too delicate and almost impracticable. There

were certain European scientists who also held the same opinion. The actual performance of the delicate operation at the hands of expert technicians created great surprise. The pearl oysters after being so treated are left for seven years in the nursery. Out of fifty oysters picked out of the bed at random, on an average thirteen contain perfectly spherical pearls. After careful examination of these pearls, the Committee came to the conclusion that they were in luster, color and shape, and in every other way, equal to natural pearls. The attainment of this remarkable success is solely dependent on the application of science. For this invention, now universally known, Mr. Mikimoto deserves the highest praise."

Prior to this Tokichi Nishikawa, a graduate of Tokyo Imperial University, who had worked as a fishery engineer for the Ministry of Commerce, began working on pearl culturing techniques with Mikimoto. The collaboration began after he attended, on Dr. Mitsukuri's behalf, the first harvest of hemispherical pearls at Mikimoto's pearl farm. When a red tide occurred at Mikimoto's pearl farm, he often visited for investigation of this recurring issue, and in 1905 he rejoined Tokyo Imperial University. In this post, he was able to devote his time to pearl research work, even at one time undertaking joint research with Mikimoto in the laboratory at his pearl farm of Tatoku Island. Under the guidance of Dr. Kakichi Mitsukuri and Dr. Isao Iijima, Nishikawa conducted research by himself at Misaki Marin Biological Station from April 1906. Striving to stimulate a pearl sac in an oyster's body to form spherical pearls, he devised a technique to transplant a small piece of mantle into an oyster's body. In 1907, based on the results of his research, Nishikawa applied for four 'Pearl formation methods' patents, one on May 13 and three on October 24, 1907. Three of his applications, Patent 29628, Patent 29629 and Patent 29630 were granted on Jun 20, 1916, with the remaining Patent 30771 on February 15, 1917. Among these four patents, Patent No.30771 became the main prototype for the technique that is now used in all pearl culturing farms worldwide today.

Before these patents were granted, Mikimoto has signed an agreement with Nishikawa to undertake experiments at Mikimoto Pearl Research laboratory in Tatoku Island to prove the techniques he had been developing. As for practical experiments on nucleus insertion, Kuwabara and Shinjuro Nishikawa, Tokichi's brother, took on this challenge. Operations were conducted for about three months beginning in September 1907, with approximately 27,000 oysters operated upon in total. To keep this research secret, Mikimoto's Pearl Research Laboratory was moved in February 1907 from Tatoku Island to the location of the Mikimoto Pearl Research Laboratory today on the mainland at

Osaki peninsula, west of Tatoku Island. After submitting an application for these patents, Nishikawa continued his research both at his own pearl farm on Awaji Island in Hyogo prefecture, and Misaki Marine Biological Station in Kanagawa prefecture. Despite tireless work on many experiments, Nishikawa sadly died in June 1909, aged thirty-five before seeing his work come to fruition.

In August 1913, at the first interim survey to monitor the progress of cultured pearl production, a sample of pearls was harvested in the presence of Dr. Isao Iijima, Sukeyo Fujita, Masayo Fujita, Shinjuro Nishikawa and Otokichi Kuwabara. The pearls harvested during this research were true spherical pearls created at the hands of cultivators, a fair number of which were collected. However, the results in terms of pearl size, yield and quality were not satisfactory. Subsequently, the techniques for culturing were improved and this knowledge was disseminated by Masayo Fujita, a disciple of Nishikawa. Nishikawa's pearl culturing technique became known as the 'Piece method', a technology that spread to foreign countries and is now widely used in the present-day pearl culturing industry. A patent for this method was applied for in Australia by his son Shinkichi Nishikawa on July 24, 1914, granted the next year on December 7, 1915 as Patent No. 13,959. The title of the patent is 'The artificial method of stimulating the formation of free pearls of regular form by pearl producing mollusca'. This stated that a nucleus of ball-shaped, shell nacre can be inserted together with a small piece of mantle tissue into the body of an oyster body to produce spherical pearls.

Tatsuhei Mise was another key person, whose work contributed to the success of culturing spherical pearls. In 1902, with an interest in pearl culturing, Mise moved 15,000 pearl oysters from Shinmei Village (present-day Shima City) to Matoya Bay, where he began his research on spherical pearl culturing. On March 1, 1907, Mise applied for a patent entitled, 'A needle to insert a nucleus for pearl coating into the mantle tissue of an oyster'. This patent, Patent No. 12598, was granted on July 27 of the same year. This patented a technique using a syringe-like tool – a needle with a sharp, slantwise cut edge – to separate a piece of the mantle, this needle then injected a small nucleus along with a piece of mantle into the tissue of an oyster where a pearl is formed.

Mise continued his research, filing another patent in 1917, which was granted three years later in 1920, as Patent No.37746. This patented a method for producing spherical pearls by making several small holes into the mantle at the place where it is attached to the flesh of an oyster towards the outer epithelium, nuclei are inserted into the holes in

the mantle, causing outer epithelial cells to intrude into the inner mantle to form a pearl sac. This is generally referred to as the 'Induction method'. However, the effectiveness of introducing epithelial cells from the outer surface of the mantle into the body of an oyster was not satisfactory for practical application.

It can be seen that the pearl forming techniques of Japanese scientists, each with their own original characteristics, were at that time the most advanced in the world. The patents they obtained prove that they had identified the reasons for pearl causation, with the cultured pearls techniques in Japan ahead of those in Europe. The efficiency of these early methods at the beginning of the 20th century, however, were so low that commercial industrialization was utterly impossible.

(Spherical pearl*: a pearl that with its entire surface covered in nacre)

2.3 Early development of the cultured pearl market

In 1918, with the prospect of industrial scale pearl culturing using the 'Wrapping method', Mikimoto set about marketing spherical pearls he had cultured for the European market, the center of the natural pearl trade at that time. Beginning with his first sales in London, Mikimoto's entry onto the European market had a great impact on European jewelers, especially in London and Paris which up until that time had dealt exclusively in natural pearls. Suspicion of cultured pearls was so aroused in London in 1921, with the flames quickly leaping to France where the Association dealing with jewelry developed Boycott movement, vociferously waging a campaign claiming cultured pearls were fake.

Against this movement, Mikimoto appealed to a civil trial, which was brought to court to decide whether cultured pearls were genuine or fake. Although the opposition, The Commercial and Industrial Association of France, tried to prove that cultured pearls were imitation, famous scholars with extensive knowledge of pearls, Professor Jameson of Oxford University and Professor Boutan of Bordeaux University bore witness at the trial to support the scientific view that "there is no difference between natural and cultured pearls in terms of their formation and structure". Finally, in 1927, a verdict was passed by the French court that "cultured pearls are the same as natural pearls". Having endured these trials, cultured pearls were finally recognized as gems in the world jewelry market.

The background of this struggle should not be forgotten, nor the efforts of the forerunners who devoted themselves wholly to culturing thickly nacred pearls to rival natural pearls. Mikimoto, along with many others, through these concrete cultured techniques and successes in attaining in industrial level production, created a jewelry market for spherical cultured pearls ahead of other countries. Nowadays, the global cultured pearl industry, which was founded in Japan, has grown into one of the largest jewelry markets in the world.

2.4 Establishment of cultured pearl industry

Since developing knowledge about how pearls are naturally formed and having had success in producing high-quality pearls, the technical developments to raise their standards for use in jewelry has since been energetically progressed. Cultured pearls not only build on the natural principles of pearl formation, but their techniques may also upgrade the quality of pearls as jewels. In the early years of spherical pearl culturing, the location for inserting the nucleus was mainly in the area surrounding the mantle. However, as the mantle of Akoya oyster is thin, it was difficult to make large sized pearls. After experimenting with different suitable locations for inserting nuclei, the gonads of an oyster have proved the most suitable region for producing large pearls. In addition, developments in nucleus insertion techniques, such as the refinement of operation tools, and improvement in the management of pearl farms, such as the suspension of culturing cages from the sea surface, the regular cleaning of shells and the wintering of oysters, have resulted in rapid improvements to the overall quality of cultured pearls. Thus, through these advances in nucleus insertion techniques and culturing activities, the mass production of quality cultured pearls was nearly perfected by the 1920's, and thereafter they have been widely distributed on the international market.

It can be said that Mikimoto and others were the first to advance concrete practical culturing methods, perfecting these techniques to the point of successful industrialization of spherical pearl culturing, which resulted in the rapid expansion of the pearl jewelry market. In 1926, when the first official statistics were announced, there were thirty-three active pearl cultivators with 669,012 pearls produced that year. Ten years later, in 1936, there were two hundred and fifty-eight cultivators producing 7,071,000 pearls, and in the following year, 1937, these two hundred and fifty-eight cultivators increased production to 10,858, 000. These numbers highlight an explosive

rise in a decade of both the number of cultivators and total pearls cultured. This achievement was due to the gradual improvements in the management of oyster culture, whilst building on the early foundations of techniques for nucleus inserting operations. It is important to highlight the contribution of Japan, whose first pearl culturing industry contributed to the establishment worldwide of a cultured pearl industry today.

3. Expansion of the pearl culturing industry

Inspired by the success of Akoya spherical pearl culturing, pearl culturing using other oyster species, such as Silver-lipped oyster, Black-lipped oyster and freshwater mussels was also developed. Meanwhile, the areas where pearl culturing was carried out were expanded, with many Japanese entrepreneurs challenging themselves to culture pearls outside of Japan.

3.1 Silver-lipped pearls

Silver-lipped pearl culturing started with a trial by Sukeyo Fujita around Zamboanga of Mindanao Island in the Philippines, and after this, Silver-lipped pearl culturing was also established in Indonesia on Buton Island in 1922. Five years later, in 1927, Fujita succeeded in producing large sized spherical pearls, commencing mass production in 1930. His pearl culturing business grew thereafter, with production reaching 5 Kan (18.8 kg) by 1936. However, in 1941, when the political situation worsened due to the threat of the Second World War, all employees and their families were forced to evacuate areas in South East Asia. After the War, pearl culturing resumed in Burma (present day Myanmar), with culturing subsequently expanded to the Philippines, Australia and Indonesia.[26]

3.2 Black-lipped pearls

In 1914, Mikimoto began Black-lipped pearl culturing in Okinawa's Nakura Bay on Ishigaki Island. At a later date, the farm was moved from Nakura to Kabira Bay due to heavy damage by a typhoon. In 1923, Mikimoto opened another farm in Koror, Palau Island. Similar to the experience on the blossoming Silver-lipped pearl culturing industry, his activities were forced to close due to the worsening political situation and outbreak of the Second World War. After the War, pearl culturing resumed in Okinawa in 1951. At that time there were several companies attempting to culture black pearls, but all of

them ended in failure. In 1953, Ryukyu Pearls Co. started culturing in Kabira Bay and after much adversity, finally succeeded in producing one hundred and twenty-three beautiful, large spherical pearls with good lusters. Thereafter, the company produced high quality pearls by improving their culturing techniques and increasing oyster production by hatchery breeding. Entering the 1980's, however, French Polynesia (Tahiti) started full-scale mass production, and since that time the center of the world market in black pearls has shifted from Okinawa to Tahiti.[26]

3.3 Freshwater pearls

Freshwater pearl culturing went into full swing with culturing experiments by Masayo Fujita using 'Karasu-gai' (Cocks Comb, *Cristaria plicata*) at a research laboratory belonging to Kyoto University's Otsu Lake Laboratory in Lake Biwa, Shiga Prefecture, Japan. The following year, in 1925, thirty-four spherical pearls that had been operated on in the previous year were harvested from 'Karasu-gai'. Later, the mussel species used changed from 'Karasu-gai' to 'Ikecho-gai' (*Hyriopsis schlegeli*). In 1935, freshwater pearl culturing was industrialized, and full-scale culturing started around Lake Biwa. Freshwater pearls cultured by 'Ikecho-gai' that possessed good commodity value were named 'Fujita Rose Pearls' and exported to England and France via Shanghai through Indian merchants. The development of this industry was interrupted, like other pearl culturing activities, by the events of the Second World War. In 1946, the freshwater pearl industry resumed, along with an important invention by Seiichiro Uda. Whilst the usual culturing method had been to make a pearl by inserting a nucleus and a piece of mantle into a mussel's body, this was replaced by a 'non-beaded method' to make a pearl by inserting only a piece of the mantle tissue into the mantle of a mussel. Since that time, the freshwater cultured pearl industry has been advanced on the basis of producing non-nucleated pearls.[26]

4. Cultured pearl industry after the Second World War

4.1 Export industry

After the War, the Japanese pearl industry gradually resumed its activities from 1949 due to loosening in that year of restrictions on pearl trading by the Allied GHQ (General Headquarters). In that same year, the present-day Fisheries Law was established, and because of measures in specific districts to allocate demarcated fishery areas for pearl

culturing and mother oyster breeding, the industry rapidly recovered a smooth production line. Serving the huge demand for cultured pearls in the American market, the industry rapidly expanded, growing even larger than before the War. The Japanese government, recognizing that cultured pearls were a principle export which contributed to the acquisition of foreign currency, protected the Japanese pearl industry by establishing the "Pearl Culture Industry Law" in 1952.

The Law consisted of the following five pillars: publication of target amounts of pearl oysters used for nucleus insertion, inspection of pearls for export, assistance for pearl oyster production, the establishment of the Pearl Culture Industry Council and the establishment of the National Pearl Institute. Under these robust protections along with other national policies, the Japanese pearl industry expanded exponentially on the basis of its export trade. As for the inspection of pearls for export, two Government Pearl Inspection Offices to uphold the pearl inspection rules of the Law were opened in 1952, one in Tokyo and the other in Kobe. To maintain confidence in Japanese cultured pearls around the world, the Government Inspection Offices classified all pearls for export as either 'High (H)' or 'Low (L)' so that they could regulate exports on low-quality pearls.

Around this time, a National Pearl Institute was established in 1955 in Kashikojima in Mie prefecture. This was a unique research organization dedicated to research on pearl and pearl culturing, which produced best practice documents in a series of 'National Pearl Reports'. With the National Pearl Institute at its center, pearl research was vigorously conducted at universities, as well as private research laboratories. These national policies, advancing quality and efficiency in production, increased the confidence in Japanese cultured pearls overseas. At each pearl farm, as the materials and equipment modernized, levels of efficiency increase so much that there was a rapid spike in pearl production. From 1955 to 1965, total pearl production in Japan increased from roughly 6,500 Kan (24.5 t) to about 30,000 Kan (114.1 t). Of this total, exports in 1955 stood at around 5,000 Kan (18.7 t) and rose to approximately 22,000 Kan (82.5 t) by 1965. The production and sale of distribution expanded nearly five times more in ten years.

However, uncontrolled rapid production to meet the demand of the market caused increased oyster mortality, conspicuous degradations in quality and decreased yields, which impacted and deteriorated the value of cultured pearls on the market. Meanwhile, a worsening of environmental conditions and lowered productivity by overcrowding

oysters was coupled with an increase in production costs stemming from these causes, which put severe pressure on the management of pearl culturing farms. As a result, by 1969, a flow of low-quality pearls in the market made overseas buyers anxious and distrustful, discouraging them from making purchases. This was a major turning point where the Japanese cultured pearl industry, which had boomed till that time, suddenly plunged into a major decline.[28] Despite the fact that there were increasing calls to stabilize production and exports, the situation in the industry had already become too chaotic and it became utterly impossible to prevent the Japanese pearl industry from spiraling into chaos. With bankruptcy declared by many pearl dealers and a contraction of business massively reducing their workforce, the government and business sector could only recover the industry by two key measures: adjusting the storage of excess pearls and controlling production by the 'Pearl Culturing Temporary Measurement Law'. In 1971, this severe depression finally came to an end, but it left serious after-effects on the pearl industry in Japan.

4.2 Expansion of domestic demand

With this depression as a turning point, many pearl dealers who had previously largely dependent on exports, headed for expansion into the domestic market in Japan. Major export and manufacturing traders strengthened their domestic sales departments by opening retail shops on busy streets or arcades in large and middle-sized cities in Japan, concentrating their efforts on partnerships with department stores. Other traders put their energy into job-area sales, training people working for them to increase sales through exhibitions. In Mie, Ehime and Nagasaki prefectures, which are still important pearl producing areas today, cultured pearls were sold as souvenirs by pearl cultivators and brokers who had had to change their job. Through these efforts the domestic market expanded to make up about one third of total pearl sales.

Due to the division of labor for pearl oyster breeding and pearl production, the efficiency of the industry increased, and by the latter half of the 1980s to the beginning of the 1990s overall production and domestic market sales expanded dramatically. During the 1980s, however, production gradually reduced because of the unstable climate and conditions for pearl farms. This was compounded by a change of sea environment and worsening of farm conditions due to increased fish culturing. As a result, oyster mortality increased and pearl quality notably degraded. Nonetheless, the decline in productivity was compensated by an increase in quantity. Unfortunately, during the 1990s, two new

unprecedented incidents occurred. The first was an unexplained mass Akoya oyster mortality in Mie prefecture in early 1990, with a second mass mortality of oysters again in 1992 in Ago Bay. A subsequent study identified a new dinoflagellate plankton, *Heterocapsa circularisquama*, as the cause of death. This plankton spread to the inner bays of seas in the West of Japan, threatening oyster culture all the more. In the latter half of the 1990s across all pearl culturing areas in Japan, there was another incident, 'Akoya oyster disease' where the color of Akoay oysters' meat changes to red and the oyster dies. This unexpected cause of death, which started in farm areas in Ehime prefecture, was a disease which spreads throughout all Japanese pearl culturing sites within three years. So significant was this damage, that it severely rocked the management of pearl farms and decreased production dramatically. It took a further study after this crisis to identify this infectious disease. Consequently in 1999, the production of pearls deceased to 6,500 Kan (24.5 t), the same level as that in 1955.

Prior to this, the National Pearl Institute, the only national-level specialized pearl research organization in the world, had ceased to exist in 1979 by unifying with the National Research Institute of Aquaculture. This meant that there was significant confusion surrounding pearl production measures to control the rampancy of the disease. Moreover, in 1997 the 'Act on Provisional Measures for the Adjustment of Pearl Culture.' was abolished, and the 'Pearl Culture Industry Law', which had supported the Japanese pearl industry for forty-six years from 1952 to 1998, was abolished on January 1, 1999. Accordingly, hidden problems, mainly globalization of the industry and liberalization, bubbled to the surface, and rapid worldwide pearl production and distribution were accelerated. As a result, Japan's prominent status in the global pearl industry was rapidly weakened, and the high reputation and value of cultured pearls that Japan had built with Akoya at its center was dramatically damaged.

4.3 Globalization of the industry

The globalization of the pearl industry had been gradually expanding despite the restrictions of the Pearl Culture Industry Law. After the expiry of this Law, however, the global expansion of the industry rapidly progressed. Previously, pearl culturing overseas had been restricted by a section of the Law called 'The three principles for the overseas pearl industry'. This was established to maintain the gem value of South Sea cultured pearls and protect Japan's original culturing techniques. This policy released by the Fisheries Secretary stated that:

1. Pearl culturing techniques shall not be disclosed to the public.
2. All cultured pearls should be exported to Japan, and Japan will obtain exclusive marketing rights.
3. The extent of production shall be controlled according to the variety of pearl and type of culturing.

As part of this policy, a prohibition on Akoya oyster pearl culturing in foreign countries was included.[29]

After the abolishment of the Law, knowledge of pearl culturing techniques was transferred abroad, and pearl culturing developed local capital as technicians began applying these techniques. Not only pearl culturing, but also pearl processing and treatments, and even nucleus manufacture had been globalized. Accordingly, the systems of values, which had been originally established by standards for Japanese Akoya cultured pearls was diversified, and other countries have since cultured, processed and treated pearls by their own valuation scales. In addition, many pearls produced in foreign countries were sold without being inspected in Japan.

Liberalization meant abolition of the regulation established by the Pearl Culture Industry Law. The most prominent was the withdrawal of export restrictions. Until that time, only pearls that passed the Japanese government inspection based on the Law could be exported. Since the abolition of the Law, however, any quality of pearl could be exported without inspection. Concurrently, in Japan it became possible for businesses which were previously excluded by the Law's regulations, to enter freely into the pearl industry, driving a rapid multiplication of pearl values and quality standards, with sales rapidly accelerating in many directions.

5. Prospects for the cultured pearl industry today

Today, pearl culturing has a presence in many countries around the world. Pearls are cultured using different species of mollusk, such as Akoya, Silver-lipped and Black-lipped, as well as Triangle freshwater mussels. The cultured pearl industry, which originated from Japan, has developed into a globally important industry by contributing to the supply and availability of pearls, advancing culturing techniques and influencing pearl jewelry fashions and designs. In 2016, the Pearl Promotion Law was established to encourage the sustainable regrowth of the cultured pearl industry by focusing on the

protection of biological resources and environmental preservation. The cultured pearl industry has now entered a regenerative phase to develop a revolutionized pearl culture and jewelry industry in Japan today.

5.1 Cultured pearls as jewels

In recent years, in response to intensive change to the aquatic environment of pearl culturing farms, it has become more important than ever to refine culturing techniques by applying rigorous scientific knowledge and information to optimize culturing management.

In many countries outside of Japan, such as Australia, China and French Polynesia (where pearl culturing is a particularly important industry), pearl research has become increasingly robust with the latest gene research in the life sciences, and studies on pearls in molecular biology making remarkable progress. With this in mind, Japan, once the world's leading cultured pearl industry, has revised the importance of conducting research on pearls. In 2011, a study by the University of Tokyo and others to investigate genes relating to pearl formation, identified a vast number of novel gene candidates, and by building up this research substantial progress has been made on understanding how nacre is formed at the gene level. Furthermore, in 2012, The Okinawa Institute of Science and Technology Graduate University (OIST), along with other research groups, became the first research unit in the world to successfully provide a complete gene analysis of the Japanese Akoya oyster. Through a return to increased research on the basic structure and process of pearl production, the science and technology for culturing pearl is again making rapid progress.[29]

For the sustainable development of pearl culturing based on a symbiotic relationship with the natural environment, research on biological resources and environmental conservation is also becoming an important theme. To ensure the stabilization and improvement of the cultured pearl industry's standards, it is important to cooperate with various research sectors, and thus a number of industry-government-university partnership have been created. Through this cooperation, there is a strengthening of work between production bases and research organizations, so that problems from the field are scientifically solved, promoting the scientific management of pearl culturing more widely.

Pearls are biominerals produced in living mollusks during the course of their natural activities. Today, most pearls distributed in the world, rather than being formed through a rare accident of nature, are almost entirely cultured pearls produced in nature by human intervention. Consequently, the term 'pearl' has now come to refer more generally to 'cultured pearls'. Pearls are gems born in a stable natural environment maintained by an ecosystem involving the living activities of various creatures. In short, they are the very symbol of a gem of life born in the natural environment. It can be said that cultured pearls are gems living together with human beings, with their beauty and value closely related to the environment in which we live. For the sustainable development of cultured pearls, it is important to understand the true value of cultured pearls and share this value with the world. This is a role that Japan – where the cultured pearl industry first grew – has taken on today.

5.2 Promotion of Pearl Jewelry Culture

In the recent Pearl Promotion Law, the 'Promotion of Pearl Jewelry Culture' is one of its stated aims. Pearl jewelry culture is generally understood as the customs relating to jewelry used for fashionable bodily adornment. This culture has existed since European royalty and titled nobility of old used rare, natural pearls abundantly as decoration on clothing and ornaments. Pearls, however, have existed through time not as mere ornaments, but have deeper symbolic cultural significance. Attitudes towards Japanese natural pearls in particular were strongly influenced by religious (Buddhist, Shinto) and agricultural practices that influenced a particular set of customs using pearls: they were donated for religious offerings, groundbreaking ceremonies, soul repose for the dead, and also used as medicine.

From the latter half of the 19th century to the first half of the 20th century, cultured pearls invented in Japan, rapidly spread to the global jewelry market, transforming pearl jewelry culture which had at that stage developed from the era of natural pearls. Those who culture pearls are connected to the natural environment, paying homage to pearl-producing oysters and nature by raising these living creatures. Thus, cultured pearls have been favored as a gem symbolic of the joint action of humans working with nature.

Over time, cultured pearls, which have been exported to countries all over the world, have enabled a new jewelry culture to blossom. As substitutes of natural pearls, cultured pearls are not only loved by a privileged elite, but they are also enjoyed by ordinary

people, using them routinely as part of their daily adornment. The quality and uniformity of cultured pearls has thus enhanced the diversity of designs for these refined ornaments, so that they can enrich the cultures of everyday life for people all over the world.

In Japan, more so than other countries overseas, it is common for Akoya cultured pearls to be mainly worn as jewelry for formal occasions such as ceremonies and celebrations. There was a time that in Japan the most popular jewel for engagement rings was Akoya cultured pearls. The reason being that not only were these pearls affordable, but they were also associated with sentiments of loyalty, oath, love purity and happiness. Pearls are gems that inherit a feeling of 'life' as their symbol. Reviving once again the pearl culture of Japan, the world history of pearl culturing and the essential values of pearls will lead to the creation of another new pearl jewelry culture to contribute to lives the world over.

The establishment of the Pearl Promotion Law aims to revive the meaning, status and value that cultured pearls once held. To share pearl jewelry culture the world over, Japanese cultured pearls should strive to enhance the intrinsic and extrinsic qualities of pearls, elaborating on their history, story, dreams and role in new fashions, whilst endeavoring to work in harmony with nature and the environment.

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Chapter 3 Basic stance of the quality standards

1. Assessing pearl quality

1.1 Background

In 1928, in order to maintain the reputation of the pearl, a domestic industry organization 'Dai Nippon (Imperial Japanese) Pearl Association' was established. To eliminate low-quality products unworthy of the title 'pearl' from the market, they obliged members of the industry to present all the pearls they had cultured so that their quality could be evaluated by two or more appraisers. As a result, pearls which had nacre that did not reach the standard thickness, had no pearl luster and/or had an extremely irregular shape were rejected and prohibited from sale.

In 1932, the Association was reorganized, and Japan Cultured Pearl Fisheries Association was born. This Association closely monitored the commodity standards for pearls, ensuring a more thorough inspection and disposing those that had been rejected. The Association also prepared other regulations concerned with inspections, arranging for exclusive inspectors to carry out this task. The process obliged the producer to reveal the results of this inspection to others in the supply chain, and pearls that were substandard were prohibited from sale. The pearls were rejected if they presented with one or more of the following characteristics:

1. It is below the standard nacre thickness.
2. It has a severely deformed shape.
3. It has no luster.
4. It possesses little practical value.
5. It is anticipated that it would be unfavorably received on the market.

Rejected pearls were divided into two groups: 1. for disposal and 2. as reserves. Pearls for disposal were burned by the Association. Reserve pearls on the other hand, which were forbidden from use as merchandise in their original state, were acquired by the Association to determine their fate. At that time, however, the world was reeling from an economic depression, and the demand for pearls as luxury goods was decreasing day by day. Nevertheless, thinly coated cultured pearls flooded the world markets through

the hands of unscrupulous dealers. Seeing this situation, Kokichi Mikimoto was concerned that this would hurt the reputation of cultured pearls and damage prospects for future trade. To set an example of good quality pearl sales therefore, he publicly burnt 36Kan (135kg, current value 48,000 JPY) of cheapjack pearls as 'creation of the pearl' in front of Kobe Chamber of Commerce. Thus, cultured pearls before the Second World War were rigorously checked according to benchmark quality standards for nacre thickness, shape, luster and color, with special attention directed towards evaluating the nacre thickness of a pearl.

1.2 The Pearl Culture Industry Law

It can be said that government inspection of pearl exports provided an opportunity to rate pearl quality in terms of shape, nacre thickness, flaw, luster and color. These standards were protected by the Pearl Culture Industry Law which was established in March 1952 to encourage the stable growth of the pearl industry.

According to a government ordinance of the Law, the 'Pearl Inspection Rule', all pearls for export underwent a classification of 'H' (high) and 'L' (low) at national pearl inspection offices; and only (H) class pearls could be exported. Although this inspection was intended to mainly classify pearls according to categories (H) and (L), in practice these categories involved five grades with the upper three grades assigned to (H) and the lower two grades (L). These grades were determined by six criteria: shape, nacre thickness, gloss, flaws (natural or processed) blemish and finish.

The colors of pearls were divided into white, silver, pink, yellow, gold, green, blue and black, with each color assigned one of the above five grades. However, this assessment did not reflect the final quality evaluation. In addition to the above mentioned quality criteria, elements of surface roughness, defective dyeing, burnishing (silicon and coating), thin coating, muddy nacre, cracks (subdivided into nucleus cracks and nacre cracks), breakages and flaws were also checked. Details of three (H) Class (Class I-III) and two (L) Class (Class Ⅳ-Ⅴ) are provided in the Guideline for compiling results of pearl export inspections as follows:

Guidelines for compiling results of pearl export inspections

Grade					
Inspection criteria	Ⅰ	Ⅱ	Ⅲ	Ⅳ	Ⅴ
	Very thick nacre (substantial	Thick nacre	Slightly thin nacre	Thin nacre	
	thickness)				
1. Nacre thickness	Example: Mid-quality pearl	Example: Mid-quality pearl	Possible to see the nucleus layer	Nucleus layer visible	Nil
	cultured over 3 years	cultured over 2 years	a little		
	Round	Semi-round	Semi-baroque	Baroque	
2. Shape	Spherical	Spherical with a little distortion	Mild distortion, some protrusion	Heavy distortion, significant	Nil
	Example: ball-shaped	Example: egg- shaped		protrusion	
3. Luster	Strong vibrant luster, deep gloss	Good luster	Ordinary luster	No luster	Nil
4. Flaw A (natural)	Nil	Slightly spotted,	Middle spots	Heavily spotted	
		Almost conspicuous	Somewhat conspicuous		Nil
B (processed)	As above	As above			
5. Spot and mud	Nil	A few	Many	Very many	Nil
	Excellent processing techniques	Excellent processing techniques	Good processing techniques, slight	Rather poor processing	
6. Finish	Excellent matching of rhe srand	Good matching of the strand	discord in matching the outer edge	techniques, and mismatching	Nil
			from the main part of the strand	of the strand	
Grade	Recognized as a gemstone	Recognized for quality high	Reconized for ordinary ornaments	No value as pearl	Nil
		ornaments			

2. Quality criteria for pearls

Quality evaluation of pearls is carried out at every stage from culturing, processing and treatment, wholesale, export and appraisal. Although the evaluation standards vary at each stage, quality criteria are evaluated according to roughly the same scales. The criteria of shape, nacre thickness, flaws, luster and color are described in the following section. Whilst size is not a quality criterion, it does influence the overall price. In case of necklaces, matching is added as an additional quality element.

2.1 Shape

As for the ideal shape, perfectly round pearls are typically highly evaluated. The reason for this may stem from the rarity of round natural pearls, a trend that remains relatively unchanged since cultured pearls were invented. Historically round pearls called Happo-korogashi, which roll in every direction where there is even the slightest slanting surface, have been highly valued. The reason why the shape of a cultured pearl is rarely perfectly round despite having a round nucleus, is because pearl oysters typically do not secrete nacreous substances evenly, and organic matter is sometimes included in the formation of a pearl. When the culturing period is longer, the rate of production of off round pearls becomes especially high because nacre thickly accumulates around the nucleus. As a result, wholly round pearls with a thick nacre are naturally those that receive the

highest valuation. Recently, however, as the number of thinly nacred, round pearls produced under a short culturing period has increased, the quality of round pearls is not necessarily high. In fact, some pearl dealers insist that transformations in the shape of a pearl are proof of the thickness of its nacre. As such, somewhat misshapen pearls with a thick nacre are more highly regarded than thinly coated, round pearls.

The shape of pearls is roughly divided into round, semi-round, semi-baroque and baroque. In the case of Silver-lipped and Black-lipped cultured pearls, other shapes such as drop, button, oval and circle are also seen. Circular Akoya cultured pearls, however, are hardly ever produced.

2.2 Nacre thickness

As the title indicates, this term refers to the thickness of a pearl's nacre. A visual assessment of the thickness of nacre is closely dependent on the color and luster specific to each pearl. The thickness and quality of nacre also has a close relationship with overall durability, an important factor in assuring a pearl's status as a jewel. Nacre thickness is typically determined by the length of culturing period. Although there are other influences, such as the characteristics of the pearl oyster and environment of the pearl farm, in general he longer pearls are cultured, the thicker their nacre becomes. As nacre is composed of thousands of thin crystals of calcium carbonate, the quality of this substance greatly affects a pearl's luster and durability.

The thickness and quality of nacre varies according to pearl oyster species. Generally, the nacre thickness of Akoya cultured pearls is thinner than Silver-lipped and Black-lipped cultured pearls. However, Akoya cultured pearls have a finely textured nacre, which produces a specific luster and iridescent color. Nacre thickness may sometimes be measured by X-ray and ultrasonic devices, but usually it is assessed by the naked eye. It should be noted that the nacre thickness standards vary from trader to trader. In the case of Akoya cultured pearls, nacre thickness is divided into three main categories, thick, middle-thick and thin.

When the crystal structure – a core component of nacre – maintain a uniform thickness, it contributes to the production of the most beautiful color iridescence and an excellently smooth surface for a pearl.

2.3 Flaws

Naturally, flawless pearls are highly valued, since flaws reflect a damages to the surface beauty of a pearl. There are many reasons that flaws occur during culturing, but the precise reasons for them are not well understood. It is generally accepted that a pearl will contain at least one or more flaws. There are two types of the flaw, a 'natural flaw' formed at the culturing stage and a 'processed flaw' which occurs after it is harvested during processing, treatment and handling.

The initial evaluation of flaws involves deciding whether it is either a natural or processed. The subsequent assessment takes into account the number, kind, size and location of the flaw(s). In the case of Akoya cultured pearls, flaws are roughly divided into flawless, small, middle and heavy. As there is no fixed evaluation system for assessing flaws, dealers often do so according to their own standards, some group flawless and small flaws together, others divide flaws into seven to eight grades. All such evaluations are carried out by the naked eye.

2.4 Luster

An evaluation of the luster of a pearl is based on a combined assessment of luster and transparency, as well as special optical properties, which occur when light is diffused and refracted to create pearl iridescence. The quality of luster is determined by the thickness of nacre, and the uniformity and transparency of the crystals that compose it.

Nacre thickness has a close correspondence with the extent to which pearls shine. Recently, with the developments in polishing techniques, shining pearls with a mirror-like surface are appearing on the market. However, this is not true deep, subtle sheen originally possessed by a pearl, it is but a mere surface reflection.

When a pearl is composed on layers of the large, compact and beautiful tabular aragonite crystals, a particular luster is created by an optical action of light. However, even if nacre is satisfactorily thick, a pearl cannot possess a good luster if the crystal layers are thick, and aragonite crystals are small and irregularly arranged as this causes too much inner diffusion of light.

The characteristics of nacre are greatly influenced by the quality of management of the

culturing phase. In the case of Japanese Akoya, a temperature drop leads to a growth of big, compact and beautiful aragonite crystals, improving the luster of a pearl. Pearl cultivators call this action 'Kesho-maki' (makeup coating). The reason the harvest is carried out in winter is because nacre's crystal structure produces the finest and most beautiful luster and iridescent color during this season.

There is no unified standard for luster. Some dealers divide luster into three categories: lustrous, middle luster and lusterless, whilst other dealers divide this even more. The evaluation of luster is often combined with an evaluation of nacre thickness. The extent of iridescence of color also affects the evaluation of luster. Assessing luster is a skilled job that requires an ability to differentiate between mere surface shine made by polishing and the deep, internal luster specific to each individual pearl.

2.5 Color

As for the color of a pearl, the first assessment is to decide whether it is natural or treated. In the case of Akoya cultured pearls, there are five different colors: natural color without any treatment except polishing, non-tinted color only altered by bleaching, tinted color by slight alteration using pigments, dyed color using dyestuff and colors created by the addition of other treatments.

The natural color of a pearl is a combination of a main color (body color) elaborately mixed with iridescent color and body color. Iridescent color is produced by a strengthening and weakening of light of a certain wavelength. A pearl creates color by reflection, refraction and iridescence of light in the stratified nacre layers. As iridescent color has a close relationship with luster, the jewel value of a pearl can be enhanced or decreased depending on this iridescence.

The body color, on the other hand, is decided by tiny pigments contained in the organic matrix of a pearl. There are yellow pigments in Akoya and Silver-lipped cultured pearls, black pigments in Black-lipped cultured pearls and orange and purple pigments in Freshwater cultured pearls. In pearl culturing, color is controlled to a certain degree. In Akoya pearl culturing, for instance, the appearance of yellow pearls is minimized by using tissue from peal oysters that contain as few yellow pigments as possible. On the other hand, in Silver-lipped pearl culturing, golden pearls are purposely produced by using oysters that contain more yellow pigment.

In addition to iridescent color and body color, there are other colors caused by organic matter, which are called blemishes. Blemishes can form between the nacre and nucleus, or between the layers of nacre, tingeing it with a brown-black color. However, when a blemish is seen through the nacre, pearls can appear blue. Pearls with this blue color are sold in the market under the name 'natural blue'.

At present, there is no unified standard nomenclature for pearl colors because of the above-mentioned complexities, so dealers often use their own names to describe the color of pearls. In the case of Akoya cultured pearls, pink, white, green, cream, gold and blue are common names. For pearls other than Akoya, names such as peacock, pistachio, cognac, wine and champagne are also seen.

There is no rule that privileges one color over another to decide which is best. The color of a pearl may be highly praised or not according to its rarity, current fashions, and differences in national and regional preferences. The most important thing to remember is that pearl color ultimately depends upon individual tastes. Though the quality of color was assigned one of five grades in the same manner as other criteria, the export inspections carried out for pearls did not consider 'base color' a determining factor in the final quality evaluation.

3. Quality inspections of pearls

3.1 Domestic quality inspections

Once there was an attempt in Japan to apply the same standards of inspection for export pearls to those intended for the domestic market. However, this presented an immense challenge as the task for export inspection had been to rate pearls as either high (H) or low (L), whereas domestic inspection had to be graded, rather than simply assigning a rating of (H) or (L).

As domestic inspections of pearls are particularly geared towards the consumer, the ranking of quality is particularly imperative. Each quality criteria of a pearl (shape, nacre thickness, flaws, luster and color) are not treated as independent, but are closely related to each other. For instance, although a shape may be poor, if its nacre thickness, luster and color are good, the pearl is highly evaluated regardless of this defect. Recently,

there has been a tendency to say that if flawed pearls produce a good luster, they can be assigned a high value despite these flaws.

At present, the biggest challenge for valuing pearls on the market is that different appraisers have judged each quality criteria individually, using their own evaluation standards to produce a final result. Whilst the highest quality pearl (which all appraisers rank at the top) and the lowest quality (L class of the pearl export inspection) can be easily classified, when it comes to middling quality pearls the situation becomes more complex. As the exact classification system differs according to the values ascribed by the individual dealer, this presents a constant challenge for standardizing pearl appraisals.

Treatment is one further aspect that must be considered in pearl quality inspection. Further developments in, and globalization of the treatment techniques mean that pearls are often widely treated overseas. Therefore, inspections must be carried out with a consideration of the treatments used to determine the extent to which pearls are damaged and how such treatments affect the quality of a pearl.

3.2 Quality inspections of pearls

During quality inspections, appraisers judge in the first instance whether the pearl tested possesses value as a jewel. This judgment is based on the high (H) class established by the past export inspection standards. When a pearl is judged low (L) class, it is rejected if it has one or more of the following characteristics.

Nacre thickness: The nacre is so thin it is possible to see the layer of the nucleus (so called 'streak'). Severely and partially thin nacre with an abnormal 'luster' is found on that spot.
Shape: Extreme ruggedness that spoils the beauty of the pearl. Noticeable circles that deform the total shape of the pearl.
Luster: A lack of pearl luster. Inclusion of a prismatic layer in the nacre which has a noticeable aesthetic impact.
Flaw: Extreme convex and concave flaws that seriously damage the surface beauty of the pearl (a natural flaw). Serious damage to the inner part of the nacre by treatments (a processed flaw).
Treatments: Serious damage on the surface of the nacre caused by excessive bleaching.

An extreme red color of the whole pearl, resulting from dyes remaining in holes, and uneven tint with streaks caused by excessive tinting.

As for pearls which are recognized as jewels by the above-mentioned inspection, appraisers categorize them according to each quality criterion. However, according to the standards of Japan Pearl Promotion Society, the individual result of each criterion does not necessarily reflect the final overall valuation of a pearl. The reason is that, as previously mentioned, valuations greatly depend on the appraiser. The Society does not object to private institutions adopting an integrated approach to overall ratings, but for the methods by which appraisals are undertaken, a standardized system based on former Japanese export inspections should be established.

An evaluation scale to provide quality definitions of pearls based on nacre thickness, luster, flaw etc., has been developed according to the former Japanese Government Pearl Inspection Office system. However, the overall evaluation standards are not fixed, since nacre thickness and luster are mutually affected, and values assigned to shape and color depend on individual taste. Therefore, whilst the Society recommends a standardized evaluation scale to undertake quality criteria inspections, the final judgment is up to the individual appraiser.

The most important thing when consumers are purchasing pearls is to disclose all necessary information on the type, quality and price of a pearl to inform their decision at the time of purchase. If the information offered is not sufficient enough or misleading, consumers will instantly lose confidence in pearls. To ensure a successful future for pearl jewelry culture, it is important to convey accurate information to customers for the creation of jewelry, and to offer quality pearls worthy of securing consumer confidence.

Chapter 4　Basic stance on processing and treatments

1. Background

Processing and treatments of the pearl are physical and chemical methods to alter shape, inner structure and weight of natural and cultured pearls, to enhance their latent beauty and to change their original color and appearance, irrespective of their original characters.

As for the treatment, it is said that the first treatment in Japan was carried out in 1922 by Yasuie Todo. He started to bleach blemished pearls after he learned that brown colored coral in Italy whitened on contact with oxygenated water. In the 1930s, pearls were often bleached and substantially dyed, a treatment method described in detail in a report by Toshikazu Horai. In the latter half of 1955, treatment methods for pearls made further progress. In particular, bleaching by irradiation using visible light, and dyeing with dyestuffs dissolved in methyl alcohol widely prevailed as a common method. Present-day methods have built on these techniques.

1.1　Processing and treatment methods

Specifically, the followings are common processing and treatment methods:

1) Drilling
   Using super-steel drills to make cylindrical holes through or into the center of pearls.
2) Cutting (including three-quarter cutting)
   Cutting a pearl (including three-quarter cutting) using tools such as diamond cutter, etc.
3) Shaping
   Changing the surface feature of pearl to improve its smoothness of curves.
4) Polishing
   Improving pearl luster by physical and chemical methods, such as barrel tumbling, animal skin polishing, buffing, high-speed polishing and acid polishing.
5) Gluing
   Sticking together cut pearls with adhesive agents.
6) Filling
   Introduction of resins or other substances into the body of a pearl to reinforce its

strength and increase its weight.

7) Coating

Covering the entire surface of a pearl with resin or other materials to reinforce its strength and improve the color and luster of a pearl.

8) Thermal processing

Removal of unfavorable colors and/or improvement of luster by heating.

9) *Mae-shori*

Soaking pearls in water or organic solvents at either room or ambient temperature to stabilize the color tone and improve the luster of pearls.

10) Bleaching

Removal of organic matter, stains (stain removal) or pigments (whitening) found in natural and cultured pearls to alter and stabilize their color.

11) Tinting

Slight color alteration of Akoya cultured pearls by the addition of red dyes to supplement the iridescent color of Akoya cultured pearl naturally possesses.

12) Dyeing

Application of natural and synthetic dyes to natural and cultured pearls to alter their color and appearance from their original character.

13) Coloration

Application of chemical reagents other than dyes to natural and cultured pearls to alter their color and appearance from their original character.

14) Irradiation

Color alterations made by irradiating a pearl with gamma rays.

15) Modification

Changing the calcium carbonate structure of nacre to a different substance using chemical reagents such as calcium fluoride for reinforcing the strength of a pearl.

16) Cultured blister (with lid) processing

The nucleus and impurities are removed after cutting away cultured blisters from the attached shell, filling the vacant part by removal with resin etc., and attaching a lid made of shell nacre.

17) Cultured blister (with shell) processing

Cultured blisters are cut out together with a part of the attached shell, for shape processing.

2. Treatment disclosures

As processing and treatments from 6) to 14) change original characteristics of natural and cultured pearls, such as color, luster, appearance and weight, they have to disclose their methods. Treatment 16) should also be disclosed since modification alters original nacre characteristics composed of calcium carbonate to different calcium fluoride, deviating from definition of the pearl. In the past, the Japanese Government pearl inspection of pearls for export decided only to disclose treatments for black pearls using silver nitrate and gamma ray irradiated blue pearls as STB (Scientifically Treated Black). Other treatments at that time did not need to be disclosed. However, on June 1, 1994, Japan Jewellery Association and Association of Gemological Laboratories in Japan established standards for the definition and nomenclature of natural stones, which obliged disclosures on the information and background of gemstones. Following this decision, Japan Pearl Promotion Society at the 6th Board of Directors on December 6 of that same year, also decided to enforce the disclosure of treatments, dividing them into two categories:

1) ENHANCEMENT

Enhancement involves optimizing the existing beauty and characteristics of a pearl. Without such pre-existing qualities, enhancement is unlikely to have a significant impact on the pearl color or its outward appearance. Although pearls are enhanced using the same techniques, the procedure produces different results from pearl to pearl (note that enhancement methods include only tinting).

2) TREATMENT

Treatments are procedures to artificially alter the color and appearance of a pearl by chemical and/or physical methods which do not rely upon enhancing the original properties that a pearl possesses (treatment methods include: color change, coloring, dyeing and irradiation).

ENHANCEMENT	
Tinted pearls	Pearls bleached, pearls slightly dyed (colored)
TREATMENT	
A Treated black pearl	Chemical color changes to Akoya and Black-lipped cultured pearls (osmic acid and silver salt treatment)
B Irradiated black pearl	Color changed to black to grey by irradiation
C Dyed blue pearl	Treated with blue dye
D Combined black pearl	Treated by B and C type method
E Dyed golden pearl	Treated with yellow dye

Later, in the United States these definitions were abolished because these were thought to be too ambiguous, so treated gems were identified according to their treatment name. Following this decision, in the first edition of the Pearl Standard issued in the year 2000 by Japan Pearl Promotion Society, it was decided that treatments of pearls should be referred to by the name of their treatment methods.

3. Overseas movements

According to a decision made by Japan Pearl Promotion Society in 1994, there was no need to disclose enhancements. The background of this decision was based on CIBJO (The World Jewellery Confederation) Pearl Book of 1991 which defined pearl treatments as follows:

Art 10

b) Bleaching of natural or cultured pearls does not need to be disclosed.

c) Regarding cultured pearls, slight alterations of tint (e.g. rose tint) caused by treatments do not need to be disclosed. Artificial coloration (e.g. stained freshwater cultured pearls, black treated cultured pearls, etc.) must clearly and openly stated.

However, in accordance with recent great change of pearl processing and treatment techniques, CIBJO has changed disclosure in Pearl Book 2020 as follows:

4.5.2.2 Cultured pearls requiring general information on treatments

Cultured pearls that have been bleached to produce a uniform white appearance shall have an asterisk on commercial documents, immediately following the description or name of the pearls that relates to a footnote of equal prominence to the description or name that appears on the same page that indicates that the cultured pearls have been bleached.

Example……cultured pearls*

*These cultured pearls have been bleached to remove or change their clour to white.

*Cultured pearls grown in the Akoya pearl oyster are usually bleached to remove blemishes between the nucleus and the nacre, to change the colour of the nacre or produce a uniform white appearance.

4.5.2.3 Cultured pearls altered by methods requiring specific treatment declarations

Cultured pearls that have been treated by dyeing (5.63), filling (5.69), heating (5.94), irradiation (5.100), lustre enhancement e.g. "Maeshori" (5.111), oiling (5.143), tinting (5.198), waxing (5.204) and chemically altered (5.38) require specific information on the treatments to be declared at the point of sale.

Treatment methods:

5.38 Chemically altered

A treatment that changes the colour of a pearl or cultured pearl without the use of a dye.

5.63 Dyed/dyeing

Application of a dye or stain to natural materials or artificial products to alter their colour.

5.69 Filling

To introduce a substance that occupies the whole or part of a void.

5.94 Heating

To heat a pearl or cultured pearl to a temperature that may alter its appearance.

5.100 Irradiated/irradiation

Exposing pearls, cultured pearls, diamonds, gemstones, synthetic stones and artificial products to any form of radiation which is controlled wholly or partially by man, usually to alter their appearance.

5.111 Maeshori treatment

A multi-part chemical treatment, including exposure to heat and/or light, that temporarily enhances lustre.

5.143 Oiling

A process, called '*decraqueler*', sometimes applied to natural and cultured pearls, whereby the surface of pearls is soaked in warm oil, to diminish the appearance of cracks.

5.198 Tinting

A treatment which causes a subtle change in colour and/or appearance (often associated with bleaching).

5.204 Waxing

The application of a colourless wax or similar products to, or near, the surface of a pearl.

In the United States, on the other hand, it was thought that the definitions of 'enhancement' and 'treatment' were too ambiguous. For this reason, these terms were abolished, and treated stones were identified by the name of their treatment method. Afterwards the Federal Trade Commission (FTC) revised FTC Guide on July 7, 2018,

and the recommendations for disclosure of treatments have been updated in Revised Jewelry Guide Ⅲ as follows:

Disclosure of treatments

It is unfair or deceptive to fail to disclose that a pearl or cultured pearl has been treated if,

(a) The treatment is not permanent. The seller should disclose that the pearl or cultured pearl has been treated and that the treatment is or may not be permanent.

(b) The treatment necessitates special care requirement for the pearl of cultured pearl. The seller disclose that a pearl or cultured pearl has been treated and has special care requirements. It is also recommended that the seller disclose the special care requirements to the purchaser.

(c) The treatment has a significant effect on the product's value. The seller should disclose that a pearl or cultured pearl has been treated.

4. Establishment of the Standards

Treatment greatly affect the quality of a pearl. As such, in 1995 the Pearl Quality Establishment Committee of Japan Pearl Promotion Society presented the following report. It is important that the standards published as part of this report become widely established industry knowledge.

> "Recent treatment techniques have progressed remarkably. Although the Committee pointed out the problem of excessive treatments, in reality each company merely copes with problems from experience, such as what kind of treatment effects what change to a pearl, and what the limits for treatments are, especially in terms of pearl's durability etc. Of course, companies fully understand that they will incur users' criticism if they continue to deal in treated pearls that lack durability. Whilst it can be seen that companies are trying to tackle the treatment problem, at present the accumulation of scientific knowledge on pearls is more abundant than ever. Therefore, it is important to continue scientific research which focuses on understanding the effects of treatments on pearls, especially the extent to which they affect pearl's durability. The methods and standards used for treatments should be based on scientific research".

Chapter 5　Basic stance on pearl inspections and differentiations

1. Background

Pearl differentiation before the invention of cultured pearl was to identify whether a peal was true or imitation. Manufacturing technique of imitation pearls were so poor that they were easily recognized as imitations with a quick glance. Differentiation of natural pearls implied appraisal concerning when, where and how the pearl was collected, and by whose hand it was offered in the market.

1.1 Differentiating natural and cultured pearls

The development of cultured pearls gave rise to a new importance on pearl differentiation. In 1919, when Kokichi Mikimoto started selling his pearls cultured at his pearl farm in Gokasho Bay, Mie prefecture in London and Paris markets, jewelers selling natural pearls in Paris were deeply wary of his products. To stem the flow of cultured pearls, they thus developed a boycott movement starting that “cultured pearls are imitations”.

Against this, Mikimoto raised a lawsuit for business obstruction, and the so-called ‘Pearl judgment’ was fought in court. At that time, the most prominent pearl experts, Dr. Jameson of England and Dr. Boutan of France, carefully examined cultured pearls and after examination, they declared that cultured pearls are true pearls. Dr. Jameson announced this result in a scientific journal ‘Nature’ in 1921. This could be said to be the first moment pearls underwent differentiation. According to the journal, he used polarized light and fluoresce with ultraviolet light, and also applied the usual methods to examine the color and luster of pearls.

When thin slices of pearls were examined by polarized light, cultured pearls could be easily distinguished from natural pearls because they contained large nucleus made from freshwater mussel. However, when it came to differentiation by non-destructive methods, it was reported that the distinction between natural and cultured pearl by polarized or other lights was almost impossible.

When they used fluorescence emitted by the irradiation of ultraviolet light, it was possible to distinguish Indian and Ceylon natural pearls from Japanese cultured pearls,

since the former emit blue fluorescence, whilst the latter green. It was reported, however, that the distinction of cultured pearls and natural pearls from other regions was impossible.

In 1924, the Paris trial was finally settled when the verdict that cultured pearls should be considered real pearls. After the settlement, various differentiation techniques were tried and tested. It can be easily imagined that at that time it was important to distinguish natural and cultured pearls. To do this, the detection of the nucleus by X-ray was the most effective methods, but it was not until 1929 that Alexander and Sherwood used this technique for the first time, and only after 1936 did X-ray become available for pearl differentiation. When Jewelry Research Laboratory of the London Chamber of Commerce and Industry started regularly using X-ray for pearl differentiation, it was widely used thereafter.

1.2 Identification by pearl oyster species

Just as making the distinction between natural and cultured pearls is crucial, so too is the identification of pearl oyster species. In 1965, when Ryukyu Pearls & Co., succeeded in culturing black pearls using Black-lipped oysters in Ishigaki Island, Okinawa, they became the only company in the world to produce cultured black pearls. However, about ten years before the appearance of true black pearls, silver nitrate treated and gamma ray irradiated Akoya and Silver-lipped black pearls were already in distribution. To distinguish treated black pearls from the true pearls cultured by Black-lipped oysters in Okinawa, methods for identifying pearl oyster species were required.

After various trials, photographic analysis using infrared color film proved effective, and result reports based on infrared photography were published. Later, an identification method using spectrophotometers was developed to check a peak of around 700nm arising from the presence of specific black pigments in Black-lipped oysters. At the same time, non-destructive analysis of the components of pearls through X-ray fluorescence had become possible. This was especially useful for detecting the existence of silver to prove whether or not a pearl had been silver-treated.

Japan's Shosoin Treasure House in Nara prefecture, where 4,158 natural pearls from the Nara Period (710 – 784 AD) are preserved, is another example of the importance of pearl oyster identification. In 1988 and 1989, investigation of these pearls was carried

out to identify their oyster species and understand where they had come from. After investigation by a polarized microscope, spectrophotometer, fluorescence spectrophotometer and X-ray fluorescence analyzer, they were identified as natural, seawater pearls from waters around the coast of Japan. At the same time, it was proven that most of these pearls were from Akoya oysters, though some were natural pearls from abalone.

1.3 Identifying pearls by place of origin

Today, the methods for identifying pearl oysters are rapidly diversifying. As the pearl culturing industry had globalized, the same species of oyster has started to be used in different pearl farms around the world. Akoya pearls are cultured in Japan, China, Vietnam and the UAE. Silver-lipped pearls are cultured in Australia, Indonesia, the Philippines and Myanmar, and Black-lipped pearls are cultured in Tahiti and Fiji. As for freshwater pearls, they are cultured in Japan and China. Though the same type of pearl oysters is used in different regions, if culturing techniques and farm environments differ, there is a significant difference in the quality and characteristics of the pearl produced. Concurrently, there has been an increasing emphasis on 'place of origin' as a brand.

Up till now, identifying pearls by place of origin and oyster species has been almost impossible as it can only be done by analyzing specific pigments and chemical elements contained within a pearl. However, with the success in 2012 by Japanese scientists to analyze the genes of Akoya oysters, there is an increased opportunity for identifying pearl oyster species and the birthplace of a pearl by examining pearl oysters' DNA. In the near future, therefore, it is anticipated that DNA analysis of pearls will become one of the main methods of identification. There is also another technique to detect trace elements contained in the pearl which is improving processes for determining a pearl's origins.

2. Identification methods

2.1 Magnification

- The surface of the pearl is magnified about one hundred times to identify whether it is true (natural or cultured) or imitation by determining the surface pattern which is characteristic of true pearls. Pearls from bivalves or snails are also identified by their

surface pattern characteristics. In the case of Conch natural pearls, a particular 'flame structure' can be seen on their surface.

- The surface of a pearl is observed by stereomicroscope and metallographic microscopes to see if it has undergone coating and/or excessive polishing. When pearls are coated or have been excessively polished, the surface pattern becomes unclear of disappears entirely.

2.2 Inner structure inspection

- Fiber optic light and X-rays are used to inspect whether a pearl is natural or cultured. As there are cultured pearls with no nucleus, such as freshwater and 'Keshi' cultured pearls, attention must be paid to the fact that non-nucleated pearls are not always natural.
- Strong condensed light from a fiberscope is irradiated onto the pearl to inspect cracks in the nucleus and nacre
- X-ray apparatus is used to examine nacre thickness, the inner state of a pearl and the type of nucleus it contains.

2.3 Spectrometric analysis

- Specific wave absorptions of around 400, 500 and 700nm are measured to identify Black-lipped cultured pearls. Akoya non-treated cultured pearls have very specific absorptions at 407, 430 and 460nm. Absorptions between 360 and 430nm are seen for yellowish Akoya and Silver-lipped cultured pearls, and specific wave length stemming from polyene pigment is also used for the identification of Conch natural pearls.
- Absorption changes near 280nm caused by conchiolin proteins in pearls are also inspected to see if they have undergone treatment. As for tinted, dyed and colored pearls, they can be identified according to their absorption characteristics to check whether the color is original or has been artificially added.

2.4 Fluorescence analysis

- Using black light, ultraviolet detectors, fluorescence spectrophotometers and fluorescence microscopes, fluorescent substances contained in pearls and added by external treatments can be analyzed to identify pearls.

- Mabé, rainbow Mabé (*Pteria sterna*) and Black-lipped cultured pearls contain porphyrin pigments that emit vivid strong red fluorescence with a peak around 620 nm. This characteristic is checked by fluorescence spectrophotometers and black light to identify the pearl oyster species.
- Changes in fluorescence caused by the conchiolin protein in pearls can be analyzed by black light, fluorescence spectrophotometers and image sensors to detect whether a pearl has been treated or not.

2.5 Composition analysis

- Using fluorescent X-ray analyzers, compositions (chemical elements) can be analyzed without causing destruction to a pearl.
- Detecting the amount of manganese and strontium by fluorescence X-ray analyzers, sample pearls can be identified as to whether they are seawater or freshwater.
- By detecting lead that is not found in real pearls, it is possible to identify whether it is imitation or not.
- By detecting silver that is not found in an original pearl, it is possible to identify whether it is silver salt treated or not.

3. Future tasks

3.1 Identification techniques

Recently, owing to the technological developments, pearl identification techniques have remarkably improved. Microscopic observations, for instance, are carried out with digital cameras equipped with microscopes, and images are processed by computers. For identification techniques using X-ray, the development of X-ray CT devices using computers can now provide a three-dimensional view inside the structure of a pearl. For the measurement of nacre thickness, ultrasound and OCT (Optical Coherence Tomography) are used. To detect whether a pearl has been irradiated or not, ESR (Electron Spin Resonance) is effective. Furthermore, though still in developmental stages, Raman spectroscopy, owing to the developments in using laser beams and the move to data processing by computers, has made it possible for pigments and dyes contained in pearls to be differentiated. Recently, some reports have revealed that DNA analysis and trace element analysis by ICP-MS can be used to identify the oyster species and place of origin of pearls.

3.2 Terms for 'Keshi'

At present, a new dispute has arisen about nucleated and non-nucleated pearls. This is not the same discussion as to whether a pearl is natural or cultured, but a problem arising from whether a cultured pearl contains or does not contain a nucleus. In the past, tiny pearls without nuclei were called 'Keshi', regardless of whether they were natural or cultured. Recently, however, nucleated pearls, where the nucleus is removed after they have been harvested, have been appearing on the market branded as 'Keshi' because they do not contain a nucleus at the time of sale. In addition, such Keshi-pretending cultured pearls are prevailing in the market; using a nucleus made of such substance as to disappear after harvest or to make the detection of its existence impossible. In these circumstances, the likely intention is to give the impression that a cultured pearl is a natural pearl by calling it 'Keshi'.

3.3 Appraising pearl quality

In recent years, with the globalization of treatment methods and diversification in the sales of cultured pearls, the processes to decide if a pearl is real or fake, natural or cultured, what oyster species it is from, and what quality it is have been presenting major problems for the pearl industry. In the past, quality was assessed by the individual characteristics of shape, nacre thickness, flaws, luster and color. However, the need to provide a total valuation based on individual quality criteria has presented an increasing challenge for appraising pearl quality.

'Hanadama' (literally 'Hana' means 'flower' and 'dama' means 'pearl'), a term originating from Akoya cultured pearls, is an example of one of these problems. The term 'Hanadama' was originally used for indicating high-quality newly harvested Akoya non-treated pearls. However, increasingly Hanadama certificate started being issued even to treated pearl products. This, in addition to a lack of unified appraisal standards, meant that there was a loss of consumer confidence in the quality of pearls.

Whilst it is easy to evaluate each quality criterion of a pearl as there is a standardized scale to this used by all appraisers, when it comes to overall valuation based on an integrated assessment of each quality criterion, this is largely down to the appraisers' own subjective opinion. A desirable colors and shapes are influenced by consumers'

current tastes, it is difficult to set an objective evaluation standard. A basic pearl appraisal, therefore, should not be narrowly focused on classifying quality criteria, but should also include the following considerations:

1. Is it true or imitation?
2. Natural or cultured?
3. Spherical or blister (Hankei)?
4. Nucleated or non-nucleated?
5. What is its oyster species (and production area if possible)?
6. Has it undergone any treatments, and if so, what are the methods by which it is treated?
7. What number of pearls are there, and what are their size and weight?
8. What are the ratings for its individual quality criteria (shape, nacre thickness, flaws, luster, color)?

Through the evaluation of each of the above points is traditionally carried out by the naked eye, making full use of scientific instruments is increasingly important as pearl appraisals need to produce accurate and trustworthy results. The recent developments in analytical instruments have been so advanced that there are now various methods that have been introduced to analyze pearl pigments, fluorescent characteristics, trace elements and isotopes, etc. Ultimately, it should be emphasized that the purpose of a pearl appraisals is to enable consumers to make correct choices when purchasing pearl products. However, unfortunately, it has been seen that in some instances, such appraisals have strayed from their original purpose to secure consumer confidence, instead becoming a mere tool for aggressive salesmanship.

Chapter 6　Related laws

1. The Pearl Promotion Law　(Law No.74, 28th Year 0f Heisei)

Delivered on 7 June 2016

(Purpose of this Law)

Article 1

The Japanese pearl industry historically occupies prominent position in the world; it is a major pearl producing nation that established pearl culturing techniques ahead of other countries. As such, there is a growing need to strengthen Japan's international competitiveness, and recognize that the pearl is a well-known national gem with a jewelry culture deeply pervades into nation's life, and plays an important role for the realization of mind enriched life of the nation. This Law, therefore, aims to contribute to the sustainable development of the pearl industry to fulfil and enhance a spiritually rich national life. The Minister of Agriculture, Forestry and Fisheries, and the Minister of Economics, Trade and Industry shall decide a basic policy to promote the pearl industry and its associated jewelry culture. They will take measures to promote stable management practices for pearl producers, advance procedures for pearl processing and distribution and promote pearl exports.

(Basic policy)

Article 2

The Ministry of Agriculture, Forestry and Fisheries, and the Ministry of Economy, Trade and Industry shall decide a basic policy (hereinafter referred to as 'the basic policy') concerning enterprises engaged in the production, processing, distribution and sale of pearls, including processed goods (hereinafter referred to 'the pearl industry'), and activities which promote the jewelry culture of pearls.

2. The following matters shall be decided in the basic policy.
    1) Matters concerning the basic significance of jewelry related to the pearl industry and pearls.
    2) Matters concerning the production target and other promotional efforts of the pearl industry focusing on the long-term perspective of pearl demand.
    3) Matters concerning measures for the promotion of the pearl industry.
    4) Matters concerning the promotion of pearl jewelry culture.
    5) Matters concerning measures to improve the demand for pearls.

3. The Minister of Agriculture, Forestry and Fisheries, and the Minister of Economy, Trade and Industry may require, in deciding the basic plan, to submit materials and seek all necessary cooperation from prefectural governors, industry groups (hereinafter referred to as 'pearl industry groups') and other concerned parties, when there is a need to understand the supply-demand situation of pearls.
4. The Minister of Agriculture, Forestry and Fisheries, and the Minister of Economy, Trade and Industry may alter the basic policy if necessary due to the change in the supply-demand situation of pearls and other circumstances.
5. When finalizing and/or altering the basic policy, the Minister of Agriculture, Forestry and Fisheries, and the Minister of Economy, Trade and Industry shall consult with the head of relevant agencies beforehand.
6. When the Minister of Agriculture, Forestry and Fisheries, and the Minister of Economy, Trade and Industry have finalized and/or made changes to the basic policy, these effects must be officially announced.

(Promotion Plan)

Article 3

Prefectures may, in adherence with the basic policy, decide a plan concerning the promotion of the pearl industry and jewelry culture of the pearl (hereinafter referred to as 'a promotion plan').
2. To develop a promotion plan, prefectures may demand that pearl industry groups and other parties concerned submit materials and provide all necessary cooperation to understand the supply-demand situation of pearls.
3. Prefectures, when deciding and/or altering a promotion plan, shall promptly announce its decision and/or alteration.

(Strengthening of Cooperation)

Article 4

The State shall, for the promotion of jewelry culture related to the pearl industry, take necessary measures for strengthening cooperation among the State, local public organizations, entrepreneurs and research organizations, such as universities.

(Stabilization of Producers' Management)

Article 5

State and local public organizations shall, in the interests of stability of pearl producers' operations, take necessary measures, such as maintenance of the pearl production base

and reasonable compensation for losses caused by disasters.

(Promotion of Productivity and Quality Improvement)

Article 6

State and local public organizations shall, in order to improve production yields and the quality of pearls (hereinafter referred to as 'the improvement of productivity and quality'), take necessary measures to support efforts for the improvement of productivity and quality by those involved in the pearl industry.

(Farm Inspections)

Article 7

State and local public organizations shall, for effective and comprehensive implementation measures to monitor pearl production, conduct investigations as needed to understand farm conditions related to pearl production, predict environmental change and implement other measures concerning pearl production.

2. State and local public organizations shall, for their contribution to the activities of pearl producers and others, supply information obtained by the investigations referred to in the previous clause.

(Maintenance and Improvement of Farms)

Article 8

To secure stable pearl production, state and local public organizations shall take necessary measures to help to maintain and improve the condition of pearl farms.

(Advancement of Processing and Distribution)

Article 9

State and local public organizations shall take necessary measures for the promotion of highly advanced pearl processing and distribution technique.

(Promotion of Exports)

Article 10

State and local public organizations shall take measures needed for the promotion of pearl exports, taking into consideration that reclamation of foreign markets contributes to an increased demand for pearls produced and processed in Japan.

(Promotion of Research and Development)

Article 11

For the advancement of pearl producing techniques, improvement of productivity and promotion of the pearl industry, state and local public organizations shall support those who promote research and development (hereinafter referred to as 'R&D') and disseminate the result of this work.

(Promotion and Maintenance of Human Resources)

Article 12

For the employment and training of talented individuals who are to carry out the efficient and stable management of pearl production, state and local organizations shall take measures to improve the production techniques and financial management skills of pearl producers. They will provide additional support, such as consultations to those who wish to engage in pearl production and use the requisite production techniques and management methods to do so.

(Promotion of Pearl Jewelry Culture)

Article 13

State and local public organizations shall take necessary measures for planning the promotion of the jewelry culture of pearls.

(Support for the Host of the Exposition)

Article 14

State and local public organizations shall support the opening of and participation in expositions, exhibitions, trade shows, prize shows and other events for the promotion of the pearl industry and jewelry cultured of pearls.

(Public Praise and Recognition)

Article 15

State and local public organizations shall publicly praise and recognize those who contribute to the promotion of the pearl industry and jewelry culture of pearls.

(National Support)

Article 16

The State shall, when implementing measures stipulated in promotion plans by local public organizations, supply information, advice, financial help and other assistance for the smooth conduct of the measures concerned.

(Supplementary provisions)
The Pearl Promotion Law shall come into force from the day of its publication.

2. The Pearl Culture Industry Law

Delivered March 25, 1952

(Purpose of this Law)
Article 1.
The purpose of this Law is to develop the culturing of pearl oysters and pearls and to improve the quality of pearls, with the object of contributing to the export of pearls and to the economic development of the nation.

(Definition)
Article 2.
"Pearl culture industry" as mentioned in this Law shall mean an industry which cultures pearl oysters or pearls, processes pearls (not including the cases where goods are manufactured by adding metals) or manufactures nuclei of pearls; and "pearl culturists" shall mean a person who engages in such pearl culture industry.

(Publication of Goal Amount for Pearl Oyster Operation)
Article 3.
The Minister of Agriculture and Forestry shall, upon hearing the opinion of the Pearl Culture Industry Council, determine every year the goal amount of pearl oyster operation in each of To, Do, Fu and prefectures, according to the sizes of nuclei, and shall make public announcement thereof.

(Submission of Plan)
Article 4.
The Minister of Agriculture and Forestry may, in accordance with the provisions of Ministerial Ordinance, request any pearl culturist to submit every year a plan for the pearl culture industry in which he engages.

(Advice and Recommendation on Plan and Assistance for Raising Fund)
Article 5.
In cases where a pearl culturist intends to determine the plan as prescribed in the

preceding Article, he may ask for an advice thereon of the Minister of Agriculture and Forestry. In this case, the Minister of Agriculture and Forestry must give such advice as may be required.

2 In cases where the Minister of Agriculture and Forestry deems it necessary to do so for the purpose of attaining the goal amount determined in accordance with the provision of Article 3, he may recommend to the pearl culturist an alteration in the plan presented as submitted under the provision of the preceding Article.

3 In cases where the Minister of Agriculture and Forestry has given an advice as prescribed in Paragraph 1 or a recommendation as prescribed in the preceding paragraph, he shall, when deemed necessary, assist the pearl culturist in raising funds needed for the industry in keeping with such advice or recommendation.

(Subsidy for Culturist of Pearl Oysters)

Article 6.

The Minister of Agriculture and Forestry may, within the limits of budgetary appropriations, grant necessary subsidy to a fishermen's cooperative association or a federation of fishermen's cooperative associations which engage in any of the following businesses:

(1) Production of pearl oyster seeds or breeding of young or adult pearl oysters;

(2) Improvement of deposits of pearl oyster beds.

(Publication of Standard Price of Pearl Oysters)

Article 7.

In cases where the Minister of Agriculture and Forestry deems it specially necessary to do so for the purpose of development of pearl oyster culturing, he may determine the standard price of pearl oysters and make public announcement thereof.

(Inspection of Pearls)

Article 8.

No pearl (including any pearl used in pearl articles) shall be exported, unless it has been subjected to the inspection of the National Pearl Inspection Office in accordance with the provisions of Ministerial Ordinance, and the result of the inspection is indicated in a form as provided by Ministerial Ordinance. However, this shall not apply in cases where pearls are exported, upon obtaining the permission of the Minister of Agriculture and Forestry, as samples or for such other uses as may be designated by the Minister of Agriculture and Forestry

2　In cases where a Ministerial Ordinance is instituted on the matters concerning the inspection and form mentioned in the preceding paragraph, the Minister of Agriculture and Forestry must approach the Minister of International Trade and Industry on such matter beforehand.

(Re-inspection)

Article 9.

Any pearl culturist or any other interested person who is not satisfied with the decision of the inspection as prescribed in Paragraph 1 of the preceding Article may file an application for holding a hearing with the Minister of Agriculture and Forestry within thirty days as from the day when such decision of the inspection was made.

2　In case where the application mentioned in the preceding paragraph has been filed, the Minister of Agriculture and Forestry must hold a hearing and examine the reason for such dissatisfaction; and if he considers that the decision of the inspection as prescribed in Paragraph 1 of the preceding Article is not proper, he must order the Pearl Inspection Office to make another inspection.

(Charge for inspection)

Article 10.

A person who intends to undergo the inspection as prescribed in Article 8 Paragraph 1 must pay to the State a charge for inspection in the amount as may be determined by Ministerial Ordinance within the limits of thirty yen per momme of pearl.

(Demanding Report and Examination by Making Entry into Plants)

Article 11.

The Minister of Agriculture and Forestry may demand a pearl culturist who has been assisted in raising funds as prescribed in Article 5 Paragraph 3 or has been granted a subsidy under the provision of Article 6 to make reports on necessary matters in order to ascertain how such funds were appropriated or has such subsidy resulted or may cause his officials to enter the office, operating unit or other places of the pearl culturist and examine the pearls, books, documents or other objects relevant thereto.

2　An official who performs examination by making entry into plants in accordance with the provision of the preceding paragraph must carry with him a card identifying his status and show it to the persons concerned.

3　The authority of making the entry and examination as prescribed in Paragraph1 must not be construed as having been recognized as criminal search.

(Establishment and Powers of Pearl Industry council)

Article 12.

In order to make research and deliberation on matters falling under the scope of its powers, in accordance with the provisions of this Law, and other important matters relating to pearl culture industry, there shall be established a Pearl Culture Industry Council (hereinafter referred to as "the Council") in the Ministry of Agriculture and Forestry.

(Organization, etc. of the council)

Article 13.

The Council shall be composed of seven members to be appointed by the Minister of Agriculture and Forestry.

2 The term of office of a member shall be two years. However, the term of office of a member appointed to fill vacancy in membership shall be the unexpired portion of that of his predecessor.

3 The council shall have a chairman who shall be appointed by mutual vote of the members.

4 The chairman shall preside over the business of the council.

5 The Council must designate from among the members in advance a member who shall act for the chairman in case the latter is prevented from discharging his duties.

6 The member shall serve part-time.

7 Other than those provided for in the preceding paragraphs, necessary matters relating to the proceedings of a meeting and the management of the Council shall be determined by the Council.

(Pearl Provisions)

Article 14.

Any person who has acted in violation of the provisions of Article 8 Paragraph 1 shall be liable to a penal servitude for a period not exceeding three years or a fine not exceeding three hundred thousand yen.

Article 15.

Any person, who has failed to make the report as prescribed in Article 11 Paragraph 1, or has made a false report, or has refused, obstructed or evaded the examination as prescribed in the same paragraph, shall be liable to a penal servitude for a period not

exceeding six months or a fine not exceeding fifty thousand yen.

Article 16.

In cases where any representative of a juridical person, or any agent, employee or other worker of a juridical person or individual has, in connection with the business affairs of the juridical person or individual, committed any violating act mentioned in the preceding two Articles, not only shall such violator be punished, but the juridical person or individual concerned shall be fined in accordance with the provisions of the respective Articles. However, this shall not apply to the juridical person or individual when the following fact was proved that neither the juridical person nor individual (his legal representative, in cases where the individual is a minor or a person adjudged incompetent who has not the same capacity in relation to business as a person of full age) failed to exercise due care in preventing the violating act concerned by the agent, employee or other worker of the juridical person or individual.

Supplementary Provisions:

(Pearl Inspection Office)

Article 7-(6)

The Pearl Inspection Office shall be an organ which conducts the Inspection of pearls.

2 The names and locations of the Pearl Inspection Offices shall be as follows:

Name	Location
Tokyo Pearl Inspection Office	Tokyo-To
Kobe Pearl Inspection Office	Kobe-City

3 The internal organization of the Pearl Inspection Office shall be determined by Ministry of Agriculture and Forestry Ordinance

(Pearl Research Laboratory)

Article 7-(7)

The Pearl Research Laboratory shall be an organ which carries on the following matters:

(1) Experiment, research and investigation relative to pearl oysters;
(2) Production and distribution of superior pearl oyster seeds;
(3) Dissemination of techniques to breed pearl oyster seeds and to culture pearl oysters;
(4) Experiment, research and investigation relative to density of pearls to be cultured and other matters relating to pearls;

(5) Dissemination of general information on pearls.

2 The Pearl Research Laboratory shall be established in Mie Prefecture.

3 The Minister of Agriculture and Forestry may establish branch laboratories of the Pearl Research Laboratory at such places as may be considered necessary for the purpose of giving partial charge of its business.

4 The internal organization of the Pearl Research Laboratory, as well as the names , locations and internal organization of the branch laboratories shall be determined by Ministry of Agriculture and Forestry Ordinance.

V Definition, classification, processing and treatments of pearls

1. Definition of pearls

Pearls are biominerals with a nacreous structure, formed in a pearl sac constructed in the body of living mollusks. They have jewelry value and their entire surface is covered with nacre (a stratified structure of calcium carbonate crystals called 'aragonite' and organic matrix called 'conchiolin') which is the same nacreous substance as that of the pearl oyster's shell. However, there are some exceptions where biominerals with no nacreous structure and formed in a pearl sac in the body of living mollusks, have also been classified as pearls.

2. Classification of pearls

2.1 Natural pearls

Pearls formed accidentally inside a living mollusk without human intervention.

2.2 Blister natural pearls

Pearls accidentally formed in a pearl sac of a living mollusk without human intervention. During the process of formation, the pearl perforates the mantle of the mollusk and attaches to the inner surface of the shell forming a lump as its surface is covered with nacre.

2.3 Cultured pearls

Pearls formed by human intervention in a pearl sac that is constructed in the body of living mollusks, the whole surface of which is covered with nacre. Human intervention involves methods which stimulate the natural process of pearl sac formation.

2.3.1 Bead nucleated cultured pearls

Cultured pearls including a bead nucleus are formed in a living mollusk in the following way:

1) Pearls are formed in a pearl sac of living mollusks by insertion of a nucleus (see Note

1), which involves a physical process of cutting and polishing freshwater mussel shells into spherical shapes, sticking it together with a piece of the mantle tissue from a donor oyster. After insertion, a pearl sac is constructed around the nucleus and within the sac nacre is secreted around the nucleus, covering its entire surface with nacre.

2) Pearls may also be formed in living mollusks which have already constructed pearl sac. After pearls are removed from a pearl sac without killing the mollusk, another nucleus is inserted on its own without a piece into the vacant pearl sac to form a pearl again.

2.3.2 Non-bead nucleated cultured pearls

Cultured pearls without a bead nucleus can form in living mollusks by following techniques:

1) Non-bead nucleated pearls can be formed in the pearl sac of living mollusks by inserting only a piece of the mantle (piece).
2) Non-beaded nucleated seawater pearls can form in the pearl sac of living oysters during bead nucleated seawater pearl production. This occurs when a piece of the mantle (piece), which is inserted into the body of a living oyster with a bead nucleus, separates from the nucleus to form a non-bead nucleated pearl.
3) Pearls can be formed in the vacant pearl sac of oysters from which cultured pearls are removed. After harvesting, further culturing of these harvested oysters with vacant pearl sac continues, and second pears are formed in the sacs.

2.3.3 Blister cultured pearls

Blister cultured pearls are those formed in the pearl sac of living mollusks by human intervention. They occur when a pearl perforates the mantle of the mollusk and attaches to the inner surface of the shell to form a blister with its surface covered in nacre.

3. Classification of blisters

3.1 Natural blister

These are blisters accidentally formed on the inner surface of mollusk shells without human intervention. They originate from the intrusion of foreign material, or by the action of mollusk to repair damaged shell bored by the invasion of sponges and parasites etc. Though the surface part of the blister is covered with nacre, the internal construction can be either hollow, or have nacre composition.

3.2 Cultured blisters

These are blisters formed on the inner surface of the shells of living mollusks that have nacre covered surfaces by closely attaching half (and three-quarter) shaped nuclei artificially to epithelial cells of the mantle. They are termed cultured blisters regardless of whether the nucleus used remains after cultivation or is removed and replaced by different substances. Pearls cut or ground to half or three-quarter sizes from spherical natural or cultured pearls are excluded from this category (see Note 2).

4. Classification of imitation pearls

Imitations are artificial products not formed in living mollusks, which are manufactured to imitate the appearance, color and other features of natural or cultured pearls. A pearl produced in this way is always an imitation irrespective of whether its physical or chemical properties are similar to that of natural or cultured pearls.

4.1 Artificially made imitations

Artificial products not formed in mollusks but manufactured by imitating appearance, color and other features of natural or cultured pearls with materials such as shell, bead nucleus, glass, plastics, fish scale etc. Even if the same materials of natural or cultured pearls are used, or if the surface is manufactured from the same nacre as natural or cultured pearls, they are still classified as imitations.

4.2 Shell-modified imitations

Artificial products manufactured by cutting a part of a snail etc. and removing the periostracum from the surface of the cut part to finish it like a pearl or blister. Artificial products can be manufactured by cutting, grinding and polishing parts of mollusk shells to look like natural or cultured pearls.

5. Pearl terms and descriptions

When dealing with natural and cultured pearls, each pearl must be termed and described in accordance with the 'Definition' set out in Clause 1, and 'Classification' set out in Clause 2. These terms and descriptions must not be abbreviated and must not be used

misleadingly (see Note 3).

5.1 Terms and descriptions for natural pearls

Natural pearls must use terms and descriptions that include the term 'natural' or other equivalent terms. Pearls other than natural pearls as classified in 2.1 and 2.2 above must not be termed and described in the same manner as natural pearls.

5.1.1 'Natural', 'Real', 'Precious', 'Orient' and 'Oriental'

The terms 'natural', 'real', 'precious', 'Orient' and 'Oriental' must not be used to pearls other than natural pearls (see Note 4)

5.1.2 'Seed' and 'Dust'

The terms of 'seed' and 'dust' must not be used to term and describe tiny pearls other than natural pearls.

5.1.3 Natural blister pearls

In accordance with Classification 2.2, the terms and descriptions for 'Blister natural Pearls' must not be used to term and describe pearls other than pearls accidentally formed on the surface of the mollusk shell.

5.1.4 Natural blisters

In accordance with Classification 3.1, terms and descriptions of 'Natural blisters' must not be used to refer to blisters other than those accidentally formed by nature as a lump on the inner surface of a mollusk shell.

5.2 Terms and descriptions for cultured pearls

Cultured pearls must be clearly termed and described that they are cultured pearls in accordance with Classification 2.3. Pearls other than cultured pearls classified in 2.3 must not be referred to in the same manner as cultured pearls.

5.2.1 'Cultured' and 'Cultivated'

Cultured pearls must be denoted by the terms 'cultured', 'cultivated' or equivalent terms such as 'Zuchtperlen'. Such terms and descriptions must not be used to refer to pearls other than cultured pearls classified in 2.3.

5.2.2 'Honshinju'

The term 'Honshinju' (real pearls) must not be applied to cultured pearls as it produces a misunderstanding that said cultured pearls are natural.

5.2.3 'Keshi'

Seawater cultured pearls without bead nuclei which are formed as a by-product during the harvest of cultured pearls must be described by the Japanese word 'Keshi'. The term 'cultured' must be added after 'Keshi' to clarify that they are the by-products of the seawater pearl culturing process. It is also recommended to identify such pearls by their oyster species, e.g. 'Akoya Keshi cultured pearl', 'Shirocho (Silver/Gold-lipped) Keshi cultured pearl' and 'Kurocho (Black-lipped) Keshi cultured pearls' (see Note 5). Association of Gemmological Laboratories Japan (AGL) describes 'Keshi' (limited to seawater pearls with size below 3mm) in the following example:

Identification result : Akoya cultured pearl.
Comment : Traditionally called "Keshi" from the shape.

5.2.4 Blister cultured pearls

In accordance with Classification 2.3.3, pearls other than those formed by human intervention on the inner surface of mollusk shell must not be termed or described as blister cultured pearls.

5.2.5 Cultured blisters (Hankei cultured pearl)

Cultured blisters (Hankei cultured pearls) must clearly be identified by their oyster species as 'Akoya Hankei cultured pearls' (or 'Akoya Hankei pearls'), 'Silver-lipped Hankei cultured pearls' (or 'Silver-lipped Hankei pearls'), 'Black-lipped Hankei cultured pearls' (or 'Black-lipped Hankei pearls'), 'Mabé Hankei cultured pearls' (or 'Mabé Hankei pearls') and 'Abalone Hankei cultured pearls' (or 'Abalone Hankei pearls'). The term 'Mabé' must not be used to generally refer to cultured blisters. Spherical natural and cultured pearls that are cut or ground into a half or three-quarter size must not be termed and described in the same manner as 'Hankei cultured pearl' (see No 6).

5.3 Imitation pearls

Imitation pearls must be clearly identified and described in full to explain that they are not real pearls (in accordance with Classification 4). Imitations must not be referred to by the terms used to describe real pearls, or the terms 'natural' and 'cultured' as defined in Section V Part 1, and Part 2.1-3 above.

5.3.1 Use of the term 'Imitation'

Descriptions of imitation pearls may only include brand names and must clarify that

they are not real pearls by using the accompanying description 'imitation' before or after the brand name.

5.3.2 'Semi-cultured', 'Half-cultured', 'Part-cultured' and 'Premature'

Terms associated with cultured pearls, such as 'semi-cultured', 'half cultured', 'part-cultured' and 'premature' must not be used to describe imitations manufactured by coating the surface of bead nuclei or other materials with an artificial film, such as plastics lacquer etc. Such imitations must be termed accordingly and described in full to clarify that they are imitation.

6. Terms and descriptions according to species

Natural and cultured pearls are referred to by their oyster or name if species is identified by a certificate of their place of origin, and features ascertained by appropriate differentiation methods (see Note 7). Basically, the order of description should begin with the name of the oyster species, then its shape and whether it is natural/cultured (however, the shape and the natural/culture distinction are sometimes placed the other way around).

6.1 Seawater pearls

Seawater natural and cultured pearls are described in Japan by their oyster name (in Japanese katakana script). In commercial trade in Japan, the names of pearl oyster species are abbreviated as follows:
Akoyagai→Akoya, Shirochogai→Shirocho, Kurochogai→Kurocho. For cultured pearls, the term 'cultured' is usually abbreviated, except for Keshi cultured pearls.

6.1.1 Natural pearls

Oyster names are included in the title only when known. If the species name is unknown, then only the term 'natural pearl' should be used.

Akoya (or Akoyagai) natural pearl
Shirocho (or Shirochogai) natural pearl
Kurocho (or Kurochogai) natural pearl
Mabé natural pearl
Abalone natural pearl
Conch natural pearl
Horse conch natural pearl

Melo natural pearl
Pen shell natural pearl
Scallop natural pearl
Quahog natural pearl
Mussels natural pearl
Natural pearl
Natural blister pearl
Natural blister

6.1.2 Cultured pearls

Oyster names are included in the title only when known. If the species name is unknown, then only the term 'cultured' should be used.

Akoya pearl (or Akoya cultured pearl)
Akoya Hankei pearl (or Akoya Hankei cultured pearl)
Akoya Keshi cultured pearl (or Akoyagai Keshi cultured pearl)
Shirocho pearl (or Shirochogai cultured pearl)
Shirocho Hankei pearl (or Shirochogai Hankei cultured pearl)
Shirocho Keshi cultured pearl (or Shirochogai Keshi cultured pearl)
Kurocho pearl (or Kurochogai pearl)
Kurocho Hankei pearl (or Kurochogai Hankei cultured pearl)
Kurocho Keshi cultured pearl (or Kurochogai Keshi cultured pearl)
Mabé pearl (or Mabé cultured pearl)
Mabé Hankei pearl (or Mabé Hankei cultured pearl)
Abalone pearl (or Abalone cultured pearl)
Abalone Hankei pearl (Abalone Hankei cultured pearl)
Cultured pearl
Cultured blister pearl
Cultured blister

6.2 Freshwater pearls

Freshwater natural and cultured pearls are not described by the species of mussel for the following reasons:

1) There are so many different kinds of mussel species capable of producing pearls that it makes it difficult to identify all their names.
2) The vast differences in common and regional names of mussels makes it difficult to identify them.

3) Occasionally, a piece of mantle tissue is inserted from different mussel sources.
4) There are hybrid species, such as '*Ikecho'* (*Hyriopsis schlegelii*) and Triangle mussel (*Hyriopsis cumingii*) which are used for pearl culturing.

6.2.1 Natural pearls

Freshwater natural pearl

Freshwater natural blister pearl

Freshwater blister

6.2.2 Cultured pearls

Freshwater cultured pearl

Freshwater cultured blister pearl

Freshwater cultured blister

7. Processing and treatments

Processing and treatments of the pearl are physical and/or chemical methods to alter shape, inner structure and weight of natural and cultured pearls, to enhance their latent beauty and to change their original color and appearance irrespective of their original character.

7.1 Processing and treatment methods

7.1.1 Drilling

Using super-steel drills to make cylindrical holes through or into the center of pearls.

7.1.2 Cutting (including three-quarter cutting)

Cutting a pearl (including three-quarter cutting) using tools such as diamond cutter, etc.

7.1.3 Shaping

Changing the surface feature of pearl to improve its smoothness of curves.

7.1.4 Polishing

Improving pearl luster by physical and chemical methods, such as barrel tumbling, animal skin polishing, buffing, high-speed polishing and acid polishing.

7.1.5 Gluing

Sticking together cut pearls with adhesive agents.

7.1.6 Filling

Introduction of resins or other substances into the body of a pearl to reinforce its strength and increase its weight.

7.1.7 Coating

Covering the entire surface of a pearl with resin or other materials to reinforce its strength and improve the color and luster of a pearl.

7.1.8 Thermal processing

Removal of unfavorable colors and/or improvement of luster by heating.

7.1.9 *Mae-shori*

Soaking pearls in water or organic solvents at either room or ambient temperature to stabilize the color tone and improve the luster of pearls.

7.1.10 Bleaching

Removal of organic matter, stains (stain removal) or pigments (whitening) found in natural and cultured pearls to alter and stabilize their color. (see Note 9).

7.1.11 Tinting

Slight color alterations to Akoya cultured pearls by the addition of red dyes to supplement the iridescent color an Akoya cultured pearl naturally possesses.

7.1.12 Dyeing

Application of natural and synthetic dyes to natural and cultured pearls to alter their color and appearance from their original character.

7.1.13 Coloration

Application of chemical reagents other than dyes to natural and cultured pearls to alter their color and appearance from their original character.

7.1.14 Irradiation

Color alterations made to a pearl by irradiation (mainly by gamma rays).

7.1.15 Modification

Changing the calcium carbonate structure of nacre to a different substance using chemical reagents such as calcium fluoride for reinforcing the strength of a pearl. (see Note 8)

7.1.16 Cultured blister (with lid) processing

The nucleus and impurities are removed after cutting away cultured blisters (see 3.2) from the attached shell, filling the vacant part by removal with resin etc., and attaching a lid made of shell nacre.

7.1.17 Cultured blister (with shell) processing

Cultured blisters (see 3.2) are cut out together with a part of the attached shell, for shape processing.

As processing and treatments from 7.1.6 to 7.1.14 change original characteristics of natural and cultured pearls, such as color, luster, appearance and weight, they have to

disclose their methods. Treatment 7.1.16 should also be disclosed since modification alters original nacre characteristics composed of calcium carbonate to different calcium fluoride, deviating from definition of the pearl.

8. Descriptions of cultured pearl standards

When handling cultured pearls as commercial products, their commodity value and quality must be disclosed. These disclosures apply to both loose (undrilled, half-drilled, drilled-through, three-quarter and Hankei) and stranded cultured pearls (threaded and/or finished strands with clasps) produced by all species of oyster.

8.1 Commodity standards

Commodity standards for valuing cultured pearls involve an assessment of the size, weight, length (if sold as a strand) and quantity of pearls.

8.1.1 Size

Sizes of pearls are described in millimeters (mm). The sizes of Akoya cultured pearl are sorted by sieves with holes that differ by half millimeter intervals. Pearls are sifted and those that remain are classified as the maximum size (Example: 7.5mm X 8.0mm). In the case of Silver-lipped and Black-lipped cultured pearls, the process to determine their size varies according to whether they are stranded, loose or loose pearls as a lot.

Stranded: the diameter is measured from vertical direction against the hole threaded the strand. The minimum and maximum size range of the pearls is determined by 0.1mm intervals (Example: 10.3mm X 15.8mm).

Loose pearls: both maximum and minimum sizes are determined by 0.1mm intervals (Example: 15.4mm X 15.8mm).

Loose pearls as a lot: Pearls are sifted with sieves which differ by 1mm intervals and the size of pearls that remain in the sieve, and those that are 1mm larger are identified (Example: 12mm X 13mm)

8.1.2 Weight

The weight of a pearl is measured by units of Momme (1 Momme =3.75g) for both stranded and loose pearls.

8.1.3 Length of a strand

The length of a strand is measured by inches (") or centimeters (cm). In case of Silver-lipped and Black-lipped strands, length is specified up to one decimal place.

8.1.4 Quantity

The quantity of stranded pearls is determined by the total number of pearls, or number of strands. Loose pearls are counted according to whether they are grouped in pieces, pairs or sets.

8.2 Quality standards

The quality of cultured pearls varies according to whether they are bead nucleated, non-bead nucleated, blister cultured pearl or cultured blister (Hankei cultured pearl). All cultured pearls should adhere to the following quality standard.

8.2.1 Bead nucleated cultured pearls

1) Pearls should possess a good luster, which has not been affected by build-up of prismatic layers and/or organic substances.
2) Pearls should possess a sufficient nacre thickness, ensuring that nuclei are not visible through the nacre.
3) Blemishes should not be severe enough to damage the structure and overall integrity of the pearl.
4) There should be no cracking in the nucleus or nacre.
5) Tinting, dyeing and coloring processes should be applied appropriately according to methods that preserve overall quality.
6) Treatments should not be excessive or affect the overall quality of the pearl.
7) Any staining should be minimized and ensure a suitable surface for work.
8) There should be no breaking or peeling of the nacre.

8.2.2 Non-nucleated cultured pearls

1) Pearls should possess a good luster which has not been affected by build-up of prismatic layers and/or organic substances.
2) Nacre should be uniformly thick, without evidence of hollow cavities inside a pearl.
3) Blemishes should not be severe enough to damage the structure and overall integrity of a pearl.
4) There should be no cracking in the nacre.
5) Tinting, dyeing and coloring process should be applied appropriately using methods that preserve overall quality.
6) Treatments should not be excessive or affect the overall quality of the pearl.
7) Any staining should be minimized ensuring suitable surface for work.
8) There should be no breaking or peeling of the nacre.

8.2.3 Cultured blisters (Hankei cultured pearls)

1) Pearls should possess a good luster, which has not been affected by build-up of prismatic layers and/or organic substances.
2) Nacre should be uniformly thick, with a smooth wrinkle-free surface.
3) Blemishes should not be severe enough to damage the structure and overall integrity of the pearl.
4) Treatments should not be excessive or affect the overall quality of pearls, and there should be no evidence of uneven dyeing or color variations.
5) There should be no visible damages, such as removal of the lid or cracks and breakages in the nacre.

9. Care of pearls

9.1 Routine care

1) Natural and cultured pearls should always be handled with care.
2) When natural and cultured pearls are worn, cosmetics should always be applied before, not after dressing.
3) Natural and cultured pearls should not be worn when undertaking heavy manual work.
4) Natural and cultured pearls should be wiped with a soft cloth immediately if they come into contact with water.
5) After wear, natural and cultured pearls should be cleaned with a soft cloth.
6) When not worn for extended periods, natural and cultured pearls should be regularly maintained by wiping with a soft cloth.
7) When storing natural and cultured pearls, they should be kept separate from other jewelry items to avoid scratches caused by contact with other materials.

9.2 Special care

In addition to routine maintenance, the following special attention should be given to natural and cultured pearls to preserve their appearance.

1) Natural and cultured pearls should not be exposed to strong natural, artificial or display lights for extended periods as this will lead to fading and/or changing the color.
2) Natural and cultured pearls should be kept away from acids and other organic

solvents.

3) Natural and cultured pearls should never be subject to ultrasonic cleaning.

10. Other related matters

10.1 'Hanadama'

According to a pearl industry regulation, 'Hanadama' indicates precious, high quality, very beautiful untreated Akoya pearls. They are cultured in Japan using Akoya oysters and are very rare. Regarding 'Hanadama' Japan Pearl Promotion Society on its homepages has called for the following:

Notice concerning the description of 'Hanadama'

"Nowadays, it has been noted that 'Hanadama', a very important term in the Japanese pearl industry, is often being used in a manner that differs from its original meaning. 'Hanadama' is a term that has been used for a long time in the pearl industry to describe "the most excellent quality pearls among harvested Akoya cultured pearls" that are not used for manufactured products. However, in the market today, variable qualities of Akoya pearls are traded under the name 'Hanadama' without a unified standard of quality in the industry. In publications entitled 'The Hanadama valuation report' issued by agencies undertaking pearl appraisal, there are clearly different applications of the term 'Hanadama' from its original meaning. There are some agencies giving the name "Hanadama" even to Silver-lipped and Black-lipped cultured pearls."

In this respect, 'Hanadama' does not always indicate "the highest quality pearl". Thus, to say at the time of sale that a pearl is of the highest quality only by reason that it has a 'Hanadama' certificate is not sufficient justification for the consumer. Such explanations only create misunderstanding and confusion amongst customers, which threatens to damage confidence in Japanese Akoya cultured pearls. As for the sale of pearls with or without a 'Hanadama' certificate, it is the responsibility of a company's workforce as specialists in pearls, to decide whether they describe these products as "the highest quality". This judgment should be handled with integrity based on an awareness of the importance of not losing consumer confidence by deviating from the original meaning of 'Hanadama'.

10.2 PS treatment

PS treatment is a method to substitute the carbonate ions of organic calcium carbonate-based gemstones (pearl and coral) with fluoride ions to improve its durability, especially its resistance against acid. In 1998, this method was patented as Patent No. 2868730, 'Manufacture of acid resistant organic gemstones'. According to the patent, the following two methods are permitted:

(1) Solution method

Prepare 2% sodium fluoride solution. By adding phosphoric acid to the solution, prepare weakly acidic solution with approximate pH 5.5. Submerge the organic gemstone in solution and leave for prescribed time (e.g. 30 minutes), heating it to maintain prescribed temperature (e.g. 30-40℃). This forms a protective film consisting of mainly calcium fluoride on the surface of the organic gemstone.

(2) Electrolysis method

Put electrolyte containing approximately 2% sodium fluoride in an electrolytic bath. Organic gemstones composed of mainly calcium are immersed near the anode to form a protective film of mainly calcium fluoride on the surface by electrolysis.

It has been reported that by these methods the calcium of the organic gemstone is strengthened to provide sixty times more acid resistance. However, the issue is debated as to whether calcium carbonate is actually replaced with calcium fluoride, and whether acid-resistance has really increased. Some appraisal agencies have different opinions on the matter, and in the past, it was argued that PS treated pearls were imitations. If the surface of the pearl has changed to calcium fluoride, this would mean that the surface of a pearl is covered with a foreign object, hence PS treated pearls should be dealt as imitations.

Japan Pearl Promotion Society defines pearls as "biominerals with a stratified structure of calcium carbonate (aragonite) and organic matrix (conchiolin)". Thus, if they are composed of calcium fluoride and an organic matrix, they do not meet the criteria to be called 'pearls'.

10.3 Imitation pearls

The history of imitation pearls is older than that of cultured pearls; it dates back to the Roman Age. In the past, when there were only natural pearls on the market, they were owned by royalty and titled nobility. As it was almost impossible for common people to

own them, imitation pearls were regularly used as substitutes. The most famous imitation pearl was made in the latter half of the 1600's by a French rosary craftsman named Jaquin, using freshwater fish cyprinid scales. He extracted guanine from fish scales, pasted it on the inside of a hollow glass ball, and was strengthened this by filling the ball with wax. Despite these efforts, it is said that the imitation pearl was so fragile that many shards of the glass were found scattered on the floor after a guest wearing a necklace containing this ball left it at a party.

The technique of making imitation pearls using fish scale spread to Japan around 1919 via Europe and America, and sometimes around 1924 and 1925, production reached its climax. In Japan, instead of herring, hairtail scales were originally used for imitations and eventually replaced by plastic.

The interesting things to note about imitation pearls is that in Europe the trend moved from natural, imitation and to cultured pearls, while in Japan, the trend shifted from natural, cultured and to imitation pearls. Therefore, imitation pearls manufactured in Japan are often mimicking cultured pearls in their names and characteristics. In the past, there was a struggle which involved the Fair-Trade Commission, concerning the description of imitation pearls as a company named Sato Pearl once manufactured and sold imitations under the name of 'The Third Pearl'. In recent years, there was another example of a company in Geneva, Switzerland, which operated inflight sales of imitation pearls under the name of "Misaki semi-cultured pearls".

Up till now, imitation pearls have been made of completely different materials to easily distinguish them from real pearls. However, in the future, it can be imagined that the substances that compose real pearls will not be made in living oysters, but in factories by techniques such as genetic manipulation. Therefore, it is crucial therefore that the naming, identification methods and standards for pearls clearly distinguish them from imitation pearls.

10.4 Nucleus

The quality of pearls should be considered with attention to the quality of the nucleus used. When cultured pearls appeared on the international market for the first time, the argument as to whether cultured pearls were true or fake became so heated that it had to be settled in court. In this dispute, the nucleus was also an important factor in

securing the verdict that cultured pearls are true pearls. If china, glass, stone and metals, such as gold and silver had been used as nuclei, cultured pearls may never have been judged as genuine.

The text of the Paris verdict on September 20, 1924 mentioned, “Japanese pearls can be regarded as high-class pearls, covered with nacre having a nacreous nucleus inside of them”. Since then, the Japanese pearl industry has been using nuclei made from nacreous materials, specifically ball-shaped nacre from freshwater mussel shells. Recently, however, the quality of nuclei that Japan has protected for a long time has been deteriorating. The following can be considered the three main reasons for this decline:

(1) Present situation of freshwater mussel shells for nuclei

In the United States, a major provider of freshwater mussel shells for nuclei manufacture, freshwater mussels are protected by the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES, Appendix I) and their collection is totally banned except for a few exempted species. Today, only one of these companies has survived meaning that that the amount supplied to Japan is drastically decreasing, and good quality nuclei are becoming highly sought after, valuable goods.

(2) The appearance of Chinses nuclei

As a result of globalization, not only pearl culturing and treatment techniques, but also nuclei manufacturing techniques have spread to China. In addition to using mussels collected in Chinese rivers, huge amounts of freshwater mussel shells intended for pearl culturing are being re-used after the harvest as material for manufacturing nuclei. As these mussels contain many orange and purple pigments in their shell nacre, the colored nuclei which result from these mussel shells are bleached with strong reduction bleaching agents, making them more fragile.

(3) The appearance of substitute nuclei

The size of nuclei used for Silver-lipped and Black-lipped pearl culturing is mostly over 8mm. The production of such large nuclei requires thick shells. However, the number of mussels with thick shells is very low, so naturally the price of nuclei made of thick shell becomes very high. For this reason, substitute nuclei are being increasingly used as replacement for ordinary nuclei.

Typical examples of substitute nuclei are those made of Giant clam shells, and glued nuclei. Both of these, however, have their own problems. As for nuclei made form Giant clam, although the catching of Giant clam is regulated by CITES Appendix II which

requires an attached certificate of origin, this regulation is often utterly neglected. As such, dealing with pearls cultured using Giant clam nuclei poses a moral dilemma for pearl dealers. Meanwhile, glued nuclei are made by sticking several, sliced freshwater mussel shell plates together to create layers that become a single thick plate, which is then shaped into large, spherical balls. Glued nuclei, however, have issues due to their poor durability and contamination by adhesive substances.

In addition, various nuclei made of fine ceramics, plastics, hydroscopic materials and wax are appearing on the market. Considering the similarity of these materials to the original characteristics of nacre through their high biological and physical resemblances, such as their specific gravity, thermal expansion coefficients and dryness shrinkage factor, the use of conventional nuclei is a method that should be maintained for the production of Japanese Akoya pearls.

Most of the reasons that pearl cultivators head for substitute nuclei reflect attempts to reduce culturing costs. When cultured pearls cannot be sold at a high price, this results in difficulties to balance culturing costs with sales, making cost reduction a natural necessity. However, pearls cultured with cheap nuclei bring further price drops, causing a vicious cycle to be repeated. High-quality pearls should be produced using decent materials and sold at a price worthy of its quality and brand. It is imperative therefore that we strive to move from a vicious to virtuous cycle.

11. Notes

Note 1

The material of a nucleus was historically limited to the nacre of freshwater mussel shells, allowing for no other materials. The reason for this goes back to the Paris court trial. In 1919, when cultured pearls were sold for the first time in European markets, they were accused being imitations, and a legal battle ensued to prove whether cultured pearls were true or imitation. The verdict of the lawsuit stated:

Paris pearl judgment (September 20, 1924)
"Estimant que la perle japonaise étant un noyau de nacre recouvert d'une materière perlière puovait être considéré comm fine" ("Japanese pearl can be regarded as high-quality gems, which have a nacreous nucleus covered in nacre").

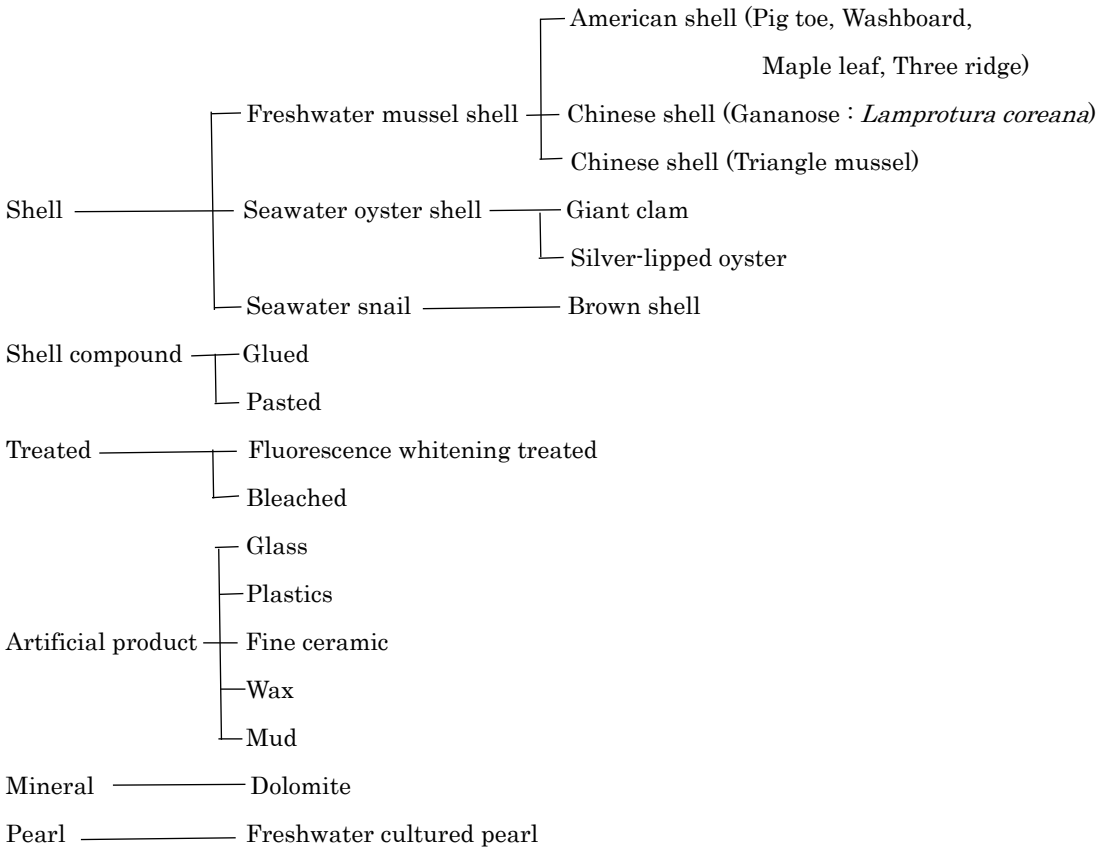
Since this verdict, Japan has traditionally used nuclei made from the shell of freshwater mussel. However, as the pearl culturing industry globalized (as the below table shows) nuclei of various materials are now used in countries across the world. It should be noted that nuclei made of Giant clam shells is in violation of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). Glued and pasted nuclei are problematic too as they have poor strength.

Nuclei should ideally be made of shell, but once substance, such as glue and resin become commonly accepted as nuclei materials, this poses a threat to the industry by increasing the ratio of poor-quality nuclei used around the world. As for the type of nucleus that should be used, this is stipulated in the CIBJO Pearl Book as follows:

CIBJO Pearl Book 5.20 Bead for cultured pearl

A sphere (usually) or other shape (occasionally) formed only by cutting and polishing a nacreous shell used to accommodate the nacre secreted from a graft of mantle tissue, which eventually forms the center of a beaded cultured pearl. That is to say, it has been prescribed that nuclei used for pearl culturing should be made by physically shaping freshwater mussel shells without the addition of any scientific treatments including bleaching.

Types of nucleus



Checking the material of a nucleus

Inspection of a nucleus is performed by considering the following criteria

- Cracks (any cracks in the nucleus layer)
- Glitter (a part of the nucleus that shines)
- Colored (colored streaks are seen)
- Streaks (striped patterns are seen)
- Skin attached (a part of periostracum of the shell is attached to the nucleus)
- Blemishes (black colored part (s) can be seen)
- Flaws (flaws can be seen in a part of the nucleus)
- Setting (a part of the nucleus is broken, deviating from spherical form)

Note 2

Though cultured blister are not pearls, the term 'pearl' was historically used for blisters,

such as Chinese Buddha pearls, Linnaeus pearls and Kokichi Mikimoto's cultured half-pearls. Even today, cultured blisters are called Hankei cultured pearls.

Note 3

The word 'pearl' can generally be used on its own without distinguishing if it is 'natural' or 'cultured' when it refers to the name of a pearl company or association. However, the terms 'natural' and 'cultured' must be included with the term 'pearl' when used to describe merchandise.

Note 4

The term 'natural' is sometimes used to refer to the natural color of pearls when they are harvested.

Examples : Silver-lipped natural golden, Akoya natural blue and Akoya natural gray. However, 'natural' should not be used to describe treated colors, such as 'natural white' for bleached but non-tinted Akoya cultured pearl.

Note 5

In CIBJO (World Jewellery Confederation)'s 1991 edition of the Pearl Book, the term 'Keshi' was defined: "'Keshi' is a Japanese trade name, which means small pearl. 'Keshi' can come from wild oyster or from cultivated oysters, as a by-product of cultivation of seawater pearls". However, in the International Pearl Design Contest of Pearl Retailers' Association in 1995 and 1996, large, non-bead nucleated pearls described as 'Silver-lipped Keshi' and 'Black-lipped Keshi' were awarded. As these descriptions were violations of the CIBJO rule, the definition was subsequently amended at CIBJO 1997 Congress in Las Vegas to provide a new definition of 'Keshi' as "non-beaded seawater pearls, which are by-products of pearl cultivation". In Japan, where freshwater pearls have been harvested for a long time in Lake Biwa, tiny pearls were harvested as by-products and have in the past been referred to as 'Freshwater Keshi'. The reason 'Keshi' is a term now confined to seawater pearls is that there are so many non-beaded freshwater pearls cultured as main products in China that it is nearly impossible now to distinguish these from 'Keshi' by-products

.

Recently, nuclei, made of various materials are used for pearl culturing. After culturing nuclei are removed from pearls and such non-beaded pearls are sold as' Keshi' since "they do not contain nuclei".

The Pearl Standard of Japan Pearl Promotion Society's definition is that "They are 'Keshi'

when a nucleus is not included in the pearl at the time of harvest". Therefore, pearls where nuclei have been removed after harvesting are not 'Keshi'. As for pearls brought into appraisal agencies for evaluation to determine whether they are 'Keshi' or not, AGL (Association of Gemological Laboratories Japan) changed the description of 'Keshi' from April 2014. This was because it was very difficult to identify whether non-beaded pearls were cultured without a nucleus or have had their nucleus removed after harvest. As a result AGL refers to 'Keshi' as "seawater pearls with sizes below 3mm" and uses the following description as an example:

Identification result : Akoya cultured pearl
Comments : Traditionally called "Keshi" due to its shape

Some dealers, however, define 'Keshi' as pearls harvested from Akoya oysters with sizes below 2mm.

Note 6

Hankei cultured pearls (cultured blisters) using Mabé pearl oysters are often treated as the representative species for producing Hankei cultured pearls. Therefore, in foreign countries, irrespective of the species of mollusk used, all Hankei cultured pearls are often called Mabé. It is a misrepresentation, however, to call Hankei cultured pearls Mabé if they are not cultured using Mabé oysters.

Note 7

Natural and cultured pearls are not necessarily referred to by their place of origin. However, the place of origin is often used for the purposes of distinguishing the same species produced in different regions. Examples include: Japanese Akoya cultured pearls, Tahiti Black-lipped cultured pearls, American freshwater natural pearls, Mexican *Pteria sterna* cultured pearls, and Kasumiga freshwater cultured pearls.

Note 8

As for treatments discussed in Section V Part 7.1.7 'Coating' and Part 7.1.15 'Modification', these were not included in the definition of the year 2000 edition of the Pearl Standard as Japan Pearl Promotion Society does not allow them.

Note 9

Reduction bleaching and fluorescent whitening, which are different from ordinary bleaching, are sometimes used. However, reduction bleaching considerably lowers the

quality of pearls, so it is not allowed by the year 2000 edition of Japan Pearl Promotion Society' Pearl Standard. As for fluorescent whitening, this treatment adds different fluorescence characteristics from that of the original pearl, so this is also not allowed by the Pearl Standard. However, AGL uses the notation "treated with fluorescent whitening agents".