

THREE-YEAR CLOSURE OF SAILFIN SANDFISH, *ARCTOSCOPUS JAPONICUS* FISHERIES AND RESOURCES MANAGEMENT IN AKITA PREFECTURE, JAPAN

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ABSTRACT

The sandfish catch in the coastal waters off Akita Prefecture has fluctuated largely over the last 40 years. It began to decrease in the middle 1970s, and in 1991 it heavily depleted by 70 tons, which corresponds to less than 1% of the catch in the 1960s. The Fisheries Cooperative Associations in Akita Prefecture closed the fishing independently from the government for three years from 1992 to 1995. After the closure, they introduced several management schemes such as a TAC system, introduced by the government of the Prefecture, reduction of fishing effort, cooperation in management with other prefectures which are suspected to have the same stock, construction of artificial spawning grounds, and releasing juveniles, artificially hatched and grown. Then, the catch recovered by 2,112 tons in 2002. The success of the rehabilitation of population was due to the success of establishing a conference system among fishermen, scientists, and the governor, clearly indicating the method to rehabilitate the stock and showing a reasonable sharing system of the management roles. This study presents the background and the factors that derived the successful management in Akita Prefecture.

Keywords: Sailfin sandfish, *Arctoscopus japonicus*, Closure of fishing Making consensus TAC
Spawning grounds Artificial breeding

INTRODUCTION

Sandfish, *Arctoscopus japonicus*, is one of important fisheries resources caught in the Sea of Japan, off the coasts of the Honshu Island of Japan and the east side of Korean Peninsula. In Akita Prefecture, the major fishing prefecture of the species, all fisher had voluntarily closed sandfish fisheries for three years from 1 September 1992 to 30 September 1995 due to the rapid decrease of their catch of the species. Then, they re-opened fishing under a very rigid management scheme. Catch has been steadily increased recently.

The purpose of this paper is to report this management practice and analyze it based on a fisheries resources management aspect.

METHODS AND RESULTS

Fluctuation of catch

Akita prefecture has historical catch data of sandfish for about 100 years (Fig.1). The largest catch was 20,600 t in 1966. The least was 70 t in 1991. The recent study shows fluctuation of sea water temperature of the Sea of Japan could make effect on the fluctuation of the catches (Sakuramoto et al., 1997).

However, the continuous lowest level of catch since 1980 is presumably caused by fishing. For example, the rate of fishing, the proportion of catch among the total amount of stock targeted, was about 0.5 in 1970s, but increased up to 0.8 in 1990s.

Fig.2 shows that the decrease of catches caused the increase of unit prices and further caused increase in fishing efforts. Such vicious circle may discourage reduction of fishing efforts even when the level of stock became low.

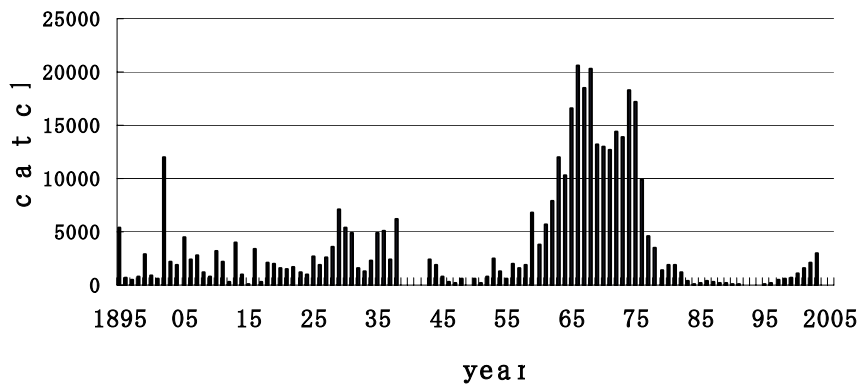


Fig. 1 The fluctuation of sandfish catch in Akita prefecture.

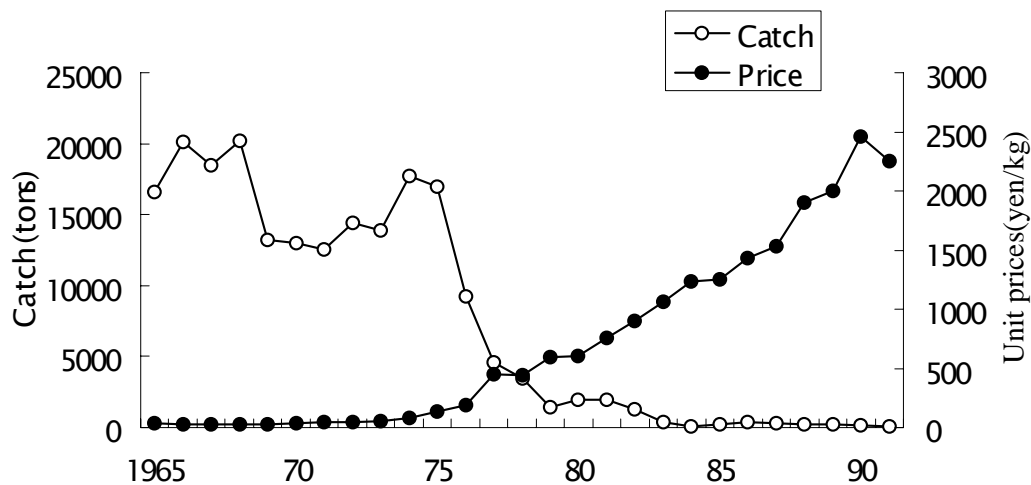


Fig.2 Trajectories of sandfish catch and the unit prices

How could we recover the depleted fisheries resources?

First, we should know the reasons. As already mentioned, in the case of sandfish, fishing activities caused adverse effects on the resources. Therefore we need to manage the fisheries.

Second, we should know the stock and fish biologically. We should find what kinds of management measures could be most effective for sandfish. We should find which stages of life cycle of the fish could be most effectively managed by human being.

Obviously we should know about the fisheries targeting the resources. Examination of the real situation of the sandfish fisheries should be essential because fishers themselves must be the main players of the management.

Finally we should also take account of any social backgrounds and make efforts for encouraging all people concerned, not only the fishers but also local and national people in general, to understand the importance of rehabilitation of the resources. Sandfish is deeply rooted in the culture of Akita Prefecture. The fish is one of important traditional food for the New Year Celebration. Processing and tourism industries also depend on the fish.

Biological characteristics of the stock

The unit of management is a stock. It is very important to define the stock targeted for management. In the case of sandfish, several stocks are identified in the Sea of Japan based on tagging surveys, distribution of spawning grounds and trend of catches.

The target stock of fishers in Akita Prefecture is called “Northern stock of the Sea of Japan”, which migrates coastal waters of Aomori, Akita, Yamagata and Niigata Prefectures and returns to the spawning areas of the coastal areas of Akita Prefecture (Fig.3)

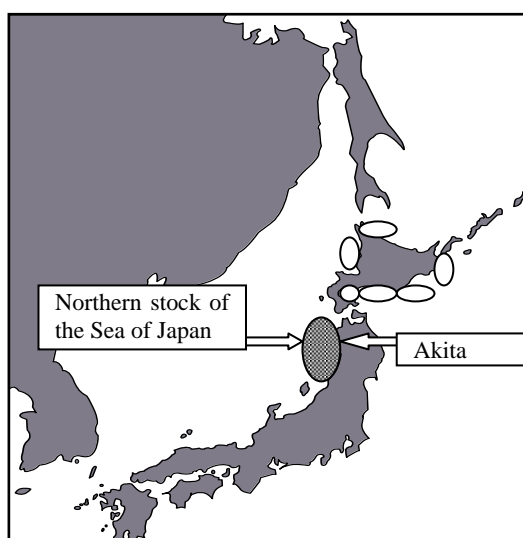


Fig. 3 Northern stock of the Sea of Japan.

The spawning season of sandfish is short, from late November to December. Spawning areas are also limited to seaweed beds in the depth of about 2 m. Since the spawning areas are easily specified, it is not difficult to manage them in coastal waters. Golf ball size bunches of eggs are spawned to stalks of gulf weeds (*Sargassum* spp.) and hatch out after two months in February. The size of hatched juveniles is rather large, about 13 mm. They grow in shallow coastal waters by preying on zooplankton. In May, the juveniles grow up to 30 mm and migrate to offshore waters as sea water temperature rises.

In offshore waters, they normally inhabit around 250 m in depth with some vertical migration and return to the seaweed beds for spawning in late November and December.

The correlation between catch per operation and depth of fishing grounds shows that the main fishing depth is around 250 m deep. Such a limited range of fishing grounds makes the set of closure areas easier. It is also easier to find any violation once it is conducted.

Life history of sandfish

Sandfish Longevity is 5 years maximum. The main targeted fish is 2-3 years old. It means that effects of management measures could be visible in the relatively short period of time.

While the main feed for the juveniles is small zooplankton, adult fish in offshore waters eats mainly micro nekton, such as Amphipod, which is abundant in the sea. Therefore feed is not supposed to be a limiting factor for the stock abundance.

Sandfish becomes matured in 2 years. The number of eggs spawned is between 600 and 2500, about 1100 on average (Fig.4). While the number of eggs increases as fish grows, the number of egg is relatively small. It means that it is very important to secure recruitment by keeping enough number of parent stocks for reproduction.

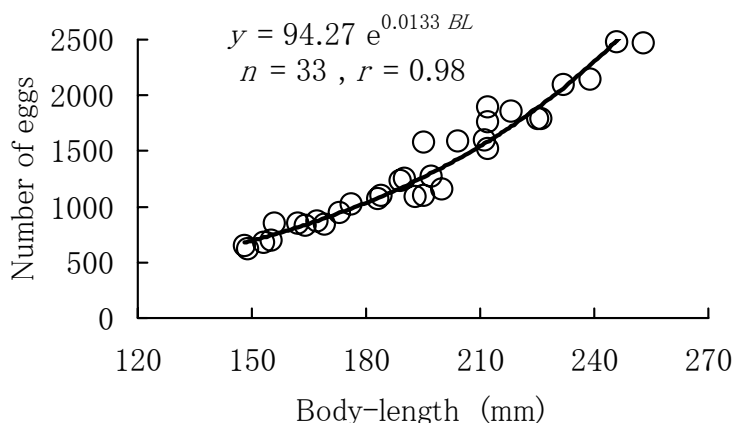


Fig.4 Relationship between body-length and the number of eggs.

The situation of the sandfish fisheries

In offshore waters, sandfish is caught by bottom trawlers (Danish seine fishery) in the depth of around 250 m, mainly from October to December. In coastal waters the fish is caught by set net and gill net fisheries around seaweed beds in a spawning season, in December.

The proportion of catches between coastal and offshore fisheries shows that the stock level became worse, the portions by offshore fisheries increased (Fig.5).

In the coastal waters, catches by gill net increased because it is more mobile, handy (easily operational by an individual) and reasonable (with lower operational costs). And the more the stock decreased, the more the catch by gill net increased (Fig.6). This shift of proportion caused conflicts between set net fishers and gill net fishers.

Introduction of the closure of fisheries

In 1992, presidents of all fisheries cooperatives in Akita Prefecture discussed the management measures for the sandfish stock. They examined effectiveness and feasibility of various kinds of management measures including the total closure of the fisheries.

Akita Prefectural Fisheries Research Institute, as the leading of the fisheries scientific advisory institute in the prefecture, explained the status of the stock and the reasons for the depletion and also suggested estimation of possible effects by the 3 year closure of the fisheries.

In order to build consensus among fishers, field seminars and questionnaires to fishers were conducted. In order to avoid conflicts between different types of fisheries, meetings among representatives of each

type of fisheries were repeatedly conducted. All those efforts became focusing toward the 3 year closures of the fisheries.

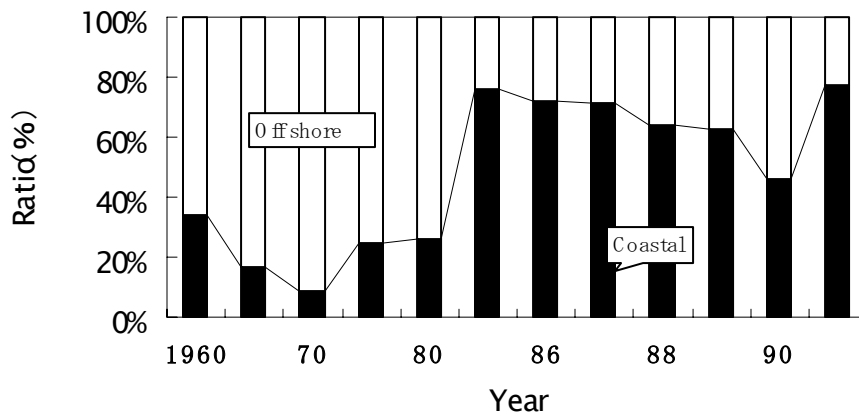


Fig.5 The ratio of the offshore and coastal catches.

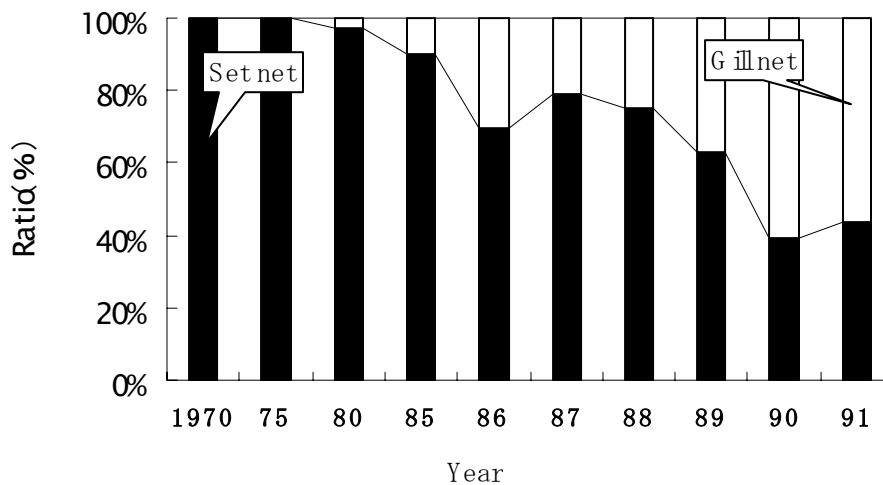


Fig.6 The ratio of the catches harvested with set net and gill net fisheries.

On 1 October 1992, “Sandfish Stock Management Agreement” was adopted by presidents of all fisheries cooperatives at the prefectural level meeting. The thrust of the Agreement was the 3 year complete closure of sandfish fisheries off the coast of Akita Prefecture including harsh penalties such as confiscation of fishing gears once any fishing is conducted against the Agreement.

During the period of the closure, many efforts were made for establishing an appropriate management scheme of the sandfish fisheries in order to prepare for the re-opening of the fisheries and sustainable management after the re-opening. In a sense, it was more difficult to re-open the fisheries than to close them because the same unfavorable situation before the closure might be easily happened unless an appropriate management scheme is introduced.

In 1993, the Sandfish Stock Management Council (35members) was established as a consultative body among representatives from the prefectural association of fisheries cooperatives, fisheries cooperatives, the prefectural government and experts for discussing the resources management plan after re-opening. The Council consists of four committees, namely Offshore Committee (24members), Coastal Committee

(33members), Stock Enhancement Committee (13members), and Marketing Committee (23members). Each committee has Area Sub-Committee, where fishers in each type of fisheries discuss the matter at the local level. Then, almost 100 sessions of meetings were held in order to create consensus among the fishers.

One of the keys for the successful management was this organization of the consultative body. In the system, while there were certain conflicts among different types of fisheries, fishers discuss and decide in each type of fisheries first, then they sought consensus between different types of fisheries in meetings with full participation of all types of fishers.

Sandfish Stock Management Plan

The first management plan, "Sandfish Stock Management Plan I" adopted after the discussion during the period of the closure. The fishers, in collaboration with the local government, could reach the decision including the rate of fishing less than 0.5 as a reference point of management before the re-opening in 1995.

The size limitation, namely prohibition on catching fish less than 15 cm, was introduced for all fisheries. For bottom trawlers (Danish seine fisheries), the closed season for six months from March-May to September was introduced. In addition, no fishing was allowed before market holidays in October. Night fishing was also prohibited. For coastal fisheries closed areas were introduced for protecting spawning areas and migratory routes to the spawning areas. The end of the fishing season was designated. For gill netters, the gear regulations on mesh size and height of nets were introduced. Fishing capacities were reduced in all types of fisheries, namely one third reduction in the number of the trawl fishing vessels, 20% cut of set nets and 40% cut of gill nets.

However, there were still some concerns left such as earlier catch by the trawlers and over all fishing pressure on the stock. Based on such concerns it was proposed to introduce a TAC system, as the "Sandfish Stock Management Plan II", into the fisheries.

The idea was to decide the total allowance catch (TAC) first and then allocate it into coastal and offshore fisheries. It made the fisheries management into a twofold way, namely input regulation by Plan I and output regulation by Plan II.

When the TAC system was introduced, Akita Prefectural Fisheries Research Institute recommended the rate of fishing as 0.5. It means the half of the targeted stock should be kept uncaught for conservation and sustainability of the stock while another half should be allocated as TAC and reallocated for coastal and offshore fisheries.

Regional Management

As we explained earlier, the targeted stock, the Northern Stock of the Sea of Japan, has a wide range of migration off the coasts of four prefectures along the coast of the Sea of Japan, namely Aomori, Akita, Yamagata and Niigata.

So far the management measures taken in Akita Prefecture, it is important and necessary for all four prefectures to take collaborative efforts for managing the stock. Therefore the Fisheries Agency of Japan established a consultative body among prefectures concerned, "Four Prefectures Council" in 1993.

The Council adopted, in 1999, "the Northern Sea of Japan Sandfish Stock Management Agreement", after 13 consecutive sessions of meetings, on the size limitation which prohibits catching fish less than 15 cm.

Stock enhancement

Another aspect of management is stock enhancement. Sandfish spawns to stalks of gulf weeds (*Sargassum* spp.) and spawning areas are very limited. Recently decrease of seaweed beds caused

destruction of the spawning areas. There were concerned phenomena observed in which a lot of bunches of eggs were beached and destroyed.

In order to enhance the sandfish stock, Akita Prefecture conducted surveys on gulf weeds beds in the spawning areas from 1993 to 1996. Then, based on the outcomes of surveys, it developed 1.3 ha of the artificial seaweed beds. The newly developed gulf weeds beds are observed to be spawned by sandfish.

Another way of stock enhancement is releasing juveniles, sea farming of sandfish. Akita Prefectural Fisheries Research Institute initiated production of sandfish juveniles in 1983 and has been developing technology as well as producing the seeds in collaboration with the Japan Sea Farming Association, the national organization established for sea farming (now merged to the Fisheries Research Agency).

The process of juvenile production of sandfish is as follows. First, to catch sandfish matured adults when they approach to the coast for spawning. Second, to put eggs out of about 20 individuals together into a bowl and mix them with sperm for insemination. Then, to attach the inseminated eggs to strings until they become firm. Finally, to put the eggs into cylinder-shaped hatchery tanks.

The number of juveniles released has been increased and now stabilized at the high level about 4 millions (Fig.7). The rapid increase in 90s depended on technical progress such as cage culture of hatched juveniles up to the size for releasing.

The more scientific approach is now sought for tracing effects of releasing such as tagging survey on juveniles in order to examine effectiveness of the stock enhancement quantitatively.

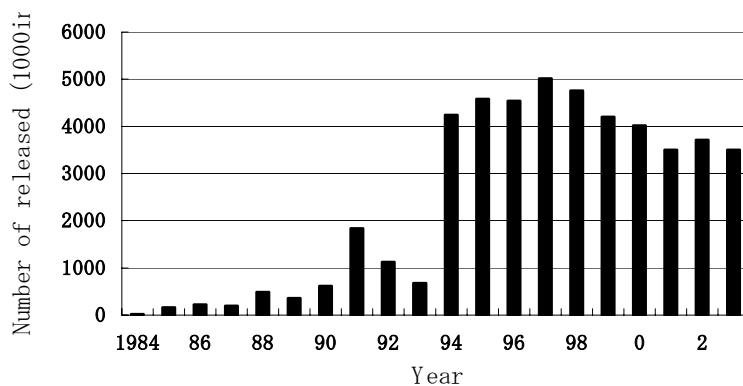


Fig.7 The number of juveniles released.

The present and the problems

Due to the efforts for stock management and enhancement, sandfish catches have been increasing recently. The catch before closure, about 70 t in 1991, jumped up to 143 t in 1995, 730 t in 1999, 1437 t in 2001 and 2114 t in 2003. The catch in 2003 is 30 times more than the one in 1991. TAC has been increasing from 170 t in 1995 at the time of re-opening to 2400 t in 2003(Fig.8).

However, the recent catches became more than TAC, meaning over harvesting. This mainly happened in the coastal fisheries partly because of biological characteristics of the fish, namely huge accumulation of fish for spawning in the short period of time in the coastal shallow waters, but partly because of competition between coastal and offshore fisheries. In order to solve the problem, firstly, we need accurate estimation of stock abundance, which is essential for creating fishers' trust on the system and consequent compliance of TAC and other relevant regulations. Second, we need to establish the mutually reliable relationship between coastal fishers and offshore fishers.

Marketing is another issue. The more catches increases, the lower prices become. The unit price was 3047 yen/kg in 1995, but down to 411 yen/kg in 2002. Therefore, while the total catch has been increasing, the revenue has been hitting its ceiling between 800-1000 million yen (US\$ 7.5-9.5 million). We need to examine marketing and distribution, as well, in order to avoid to diminish the increase in catches by the decrease in prices.

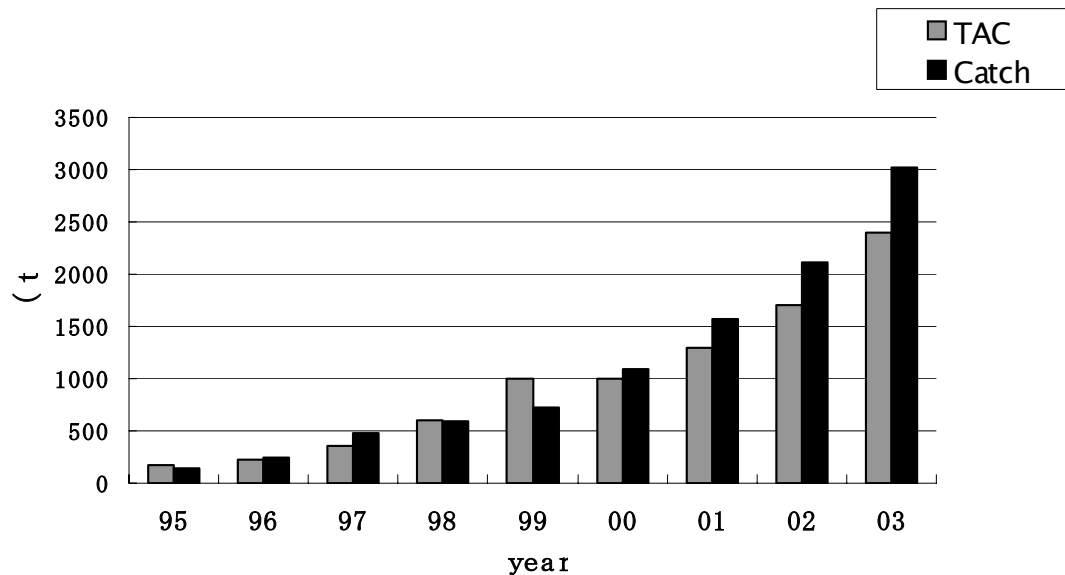


Fig.8 TAC and the actual sandfish catch

Conclusion

In order to establish sustainable fisheries and stock management, the following are particularly important:

1. Decision on management target

In order to make management effective, we have to decide which stock should be the targeted stock of the management and find biological and ecological characteristics of the stock. We also need to know exactly the actual situation of fisheries targeting the stock. It is very important to identify what kinds of management measures would be best fitting to the targeted stock and fisheries.

2. Establishment and operation of the management body

It is essential to organize the management body in which the effectiveness of the management measures is fully examined and decision-making system fully functions for making consensus on any management measures.

3. Implementation of management measures

Implementation of the management measures should be rigid but enough flexible to accommodate any unforeseen changes. It should be also comprehensive to include not only fishing regulations but also stock enhancement measures such as sea farming and spawning grounds development.

4. Monitoring and feedback to sustainable management

The status of stock and effectiveness of the management measures should be continuously monitored and the result of monitoring should be fed back to management practices for securing sustainability of the management.

In conclusion, it is basic and essential that the people who need the fish most should have the main responsibility for management of the fish and conduct the effective management measure respectively and collaboratively in each capacity and competence.

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