The Investigation On And The Sustainable Management of The Jellyfish Lake.

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Abstract

From September to May every year, it is the best viewing time for Cassiopeia jellyfish. My hometown is located in Linyuan District, the southernmost tip of Kaohsiung, Taiwan. The unique Ocean Wetland Park in Linyuan District not only has mangrove landscapes, diverse creatures, attractive beaches, and the only upside-down jellyfish on the island of Taiwan. Through media reports, many tourists come here for jellyfish. I wonder why Linyuan Wetland Park has the only jellyfish lake in Taiwan. To find out the reasons, I went to Linyuan Wetland Park to test the relevant water quality near Jellyfish Lake. I wanted to know why Cassiopeia jellyfish only survive here. I also wanted to explore the long history about rich landscape and biological resources in the forest garden. How did the Ocean Wetland Park develop into its current state through management and operation?

The Purpose of the Research

1. Investigating the environment of upside-down jellyfish in Linyuan Wetland Park.

2. Interview with private management units on the management and operation of Linyuan Wetland Park.

3. Discuss the community creation and sustainable development direction of Linyuan Ocean Wetland Park.

Literature Review

1. Cassiopeia Jellyfish

Cassia Queen's (*Cassiopea Andromeda*), also known as upside-down jellyfish and chaotian jellyfish in Chinese, is a cnidarian. Compared with other jellyfish, its characteristic is that it often faces down with its umbrella, which seems to stand upside down. Therefore, the media and residents most often call it an upside-down jellyfish. "**Cassia Queen's jellyfish has Zooxanthellae on its body and mouth, which can supply energy by photosynthesis through its mouth and tentacles facing upward"** (National Museum of Natural Science). Because they can provide their own energy, Cassiopeia jellyfish are unlikely to swim a lot. Although upside-down jellyfish can carry out photosynthesis to supply energy on their own, they s)ll prey on small plankton with their tentacles, which are carnivorous. "**The tentacles are poisonous, and the skin of the human body will become red and swollen when they sting.**"

(National Museum of Natural Science). Hence, the tourists are not allowed to touch the jellyfish, and remind the public not to flip the jellyfish. Their behavior may cause the jellyfish to be injured and die. In addition, the jellyfish has symbiotic algae, so the color of each jellyfish will also be affected by the symbiotic algae. In addition to commercial viewing of Cassiopeia jellyfish, in order to solve the problem of overpopulation of Cassiopeia jellyfish, many uses other than ornamental have been developed in recent years. "**After repeated cell proliferation experiments, the team found that Cassiopeia jellyfish extract has a positive effect on skin cells."** (Cai Guangnan, 2018) Then the skin care, moisturizing products, jellyfish mask, etc. were developed, and it "**(Cassia Queen's Jellyfish) became most popular beauty product on the internet**"(Guo Huirui ,2021). It can be seen that jellyfish products set off a lot of shopping storms on the Internet.

2. Linyuan Ocean Wetland Park

Learn about Linyuan Ocean Wetland Park from three different aspects: sightseeing, education, and characteristics.

Introduction:

Linyuan Ocean Wetland Park is located in Linyuan District, Kaohsiung City. It was established in May 103. It is an artificial wetland park. It is managed by Maintenance Office, Public Works Bureau of Kaohsiung City Government, close to the sea and there are many aquaculture fisheries around it. When it was not developed into a wetland park, it was a mangrove landscape. "**Mangroves grow well, and a green forest is formed in the intertidal zone, which not only achieves the effect of greening and beautifying, but also provides more food sources for intertidal organisms.**" (Chen Junqiang, 2015) It can be seen that there are many species living here. The most commonly seen species of mangroves here are Shui-bian and Pleurotus chinensis. Among them, the mangroves have been around for about 150 years. "**The total area of the Linyuan Wetland Park base is about 6.2 hectares. After deducting the sea area, the remaining area is about 5 hectares. Although the wetland area is not large, it is indeed a very typical pocket-sized wetland.**" (Kaohsiung Municipal Public Works Office) From the above, it can be seen that the area is not large.

(1) Sightseeings

Because the park has "**endless scenery adjacent to the Taiwan Strait**" (Linyuan District Office, Kaohsiung City), people choose to go here to enjoy the sea view and walk on the beach in addition to viewing the Cassia Queen's Jellyfish Lake.

In recent years, the jellyfish lake in the park has been reported heavily by the media, so the jellyfish lake is the most attractive place for people to come. Linyuan Ocean Wetland Park was established to provide a good place for the public to rest, so there are also have management rooms, toilets, parking lot, and guides in the park. The commentary board also has a guide and commentary service on holidays. Because it is an open space, there are facilities provided in the park, including the guide and commentary, which are free.

(2) Education

In addition to tourists visiting here, there are also many educational promotions actively launched, such as guided tours and "**touring wetland education and promotion in schools, with wetland conservation as the theme, conducting wetland exhibitions and exhibition teaching**" (105 National Important Wetlands Land Conservation Project), so that local students can fully understand the types of wetlands and the characteristics of their hometowns.

(3) Feature

Having the only Cassia Queen jellyfish lake in Taiwan, the jellyfish lake is just a flood detention pond in the park. Later, in order to solve the problem that the low water level and high-water temperature make it difficult for animals and plants to survive here, a pumping motor was added in the park to make the water flow resource recycling to solve the problem. It is judged that the flood detention pond has become a jellyfish lake because of the development in recent years, "**there are a large number of polyps in the recycled aquaculture wastewater, and there are aquatic plants and sea eggplant winter respiratory roots in the water injection channel, which are favorable for the polyps to climb and form a favorable growth environment.**" (Lin Yuanai Chairman of the Township Association, Chen Junqiang) From the above, Linyuan Ocean Wetland Park has become more conducive to the reproduction and growth of Cassia Queen jellyfish, and the number of jellyfish lakes has reached tens of thousands in 2022 according to statistics.

Research Method

The research uses Field Measurement, Literature Review, Data Analysis, Interview Survey, SWOT Analysis to conduct.

1. Field Measurement:

Visited Linyuan Ocean Wetland Park to collect the first-hand information, design 6 points around the jellyfish lake, and design another 2 points at the upstream of the jellyfish lake, that is, where the factory discharges wastewater. After determining the location, draw a point map, and detect the basic water quality repeatedly, and obtain data of each point at five different moments. The data includes the temperature, humidity, PH value of water, total dissolved solid matter in water, electrical conductivity, water temperature, dissolved oxygen, hardness, total chlorine, residual chlorine, nitrate, nitrite, carbonate, total alkali, hydrogen, redox potential, resistivity, salinity, seawater specific gravity and fertility.

2. Literature Review:

From the library and Internet academic papers to collect a large amount of relevant knowledge about wetlands, jellyfish, management, sustainable development, etc. The purpose is to understand the relevant background of Linyuan Ocean Wetland Park and its impact on the local area.
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3. Data Analysis:

Data comparison of each point:
The environmental characteristics measured on the spot (air temperature, humidity, pH value, total dissolved solid matter in water, electrical conductivity, water temperature, dissolved oxygen, hardness, total chlorine, residual chlorine, nitrate, nitrite, carbonate , total alkali, hydrogen, oxidation-reduction potential, resistivity, salinity, seawater specific gravity, and fertility) are sorted into Excel, and some variables with large variability or characteristics are selected to present the environmental characteristics of each point.

4. Interview Survey:

Interviews from the telephone with the two non-governmental associations most closely related to Linyuan Ocean Wetland Park, Linyuan Love Hometown Association and Linyuan Mangrove Conservation Association, to learn about the tourism, economy, manage thinking in three aspects.

5. SWOT Analysis:

Use the SWOT analysis method to draw maps to analyze the strength, weakness, opportunity, and threat of Linyuan Ocean Wetland Park, and present them in the form of pictures, which is easier to understand.

Analysis and Results of research

1. Draw a sampling point map

Points 1, 2, 3, 4, 5, and 6 in Figure 1 are surrounded by the ecological pool (jellyfish lake). Point 1 is under the bridge and there are many small jellyfish. Points 2 to 6 have many jellyfish and all It is a big jellyfish, and the number of jellyfish in each point is different, so we chose to design six points here, and points 7 and 8 are designed next to the ditch at the water inlet of the ecological pool. Because the ditch is adjacent to the factory. Therefore, the water in the ditch contains industrial wastewater, and many small fish are also found in the ditch.

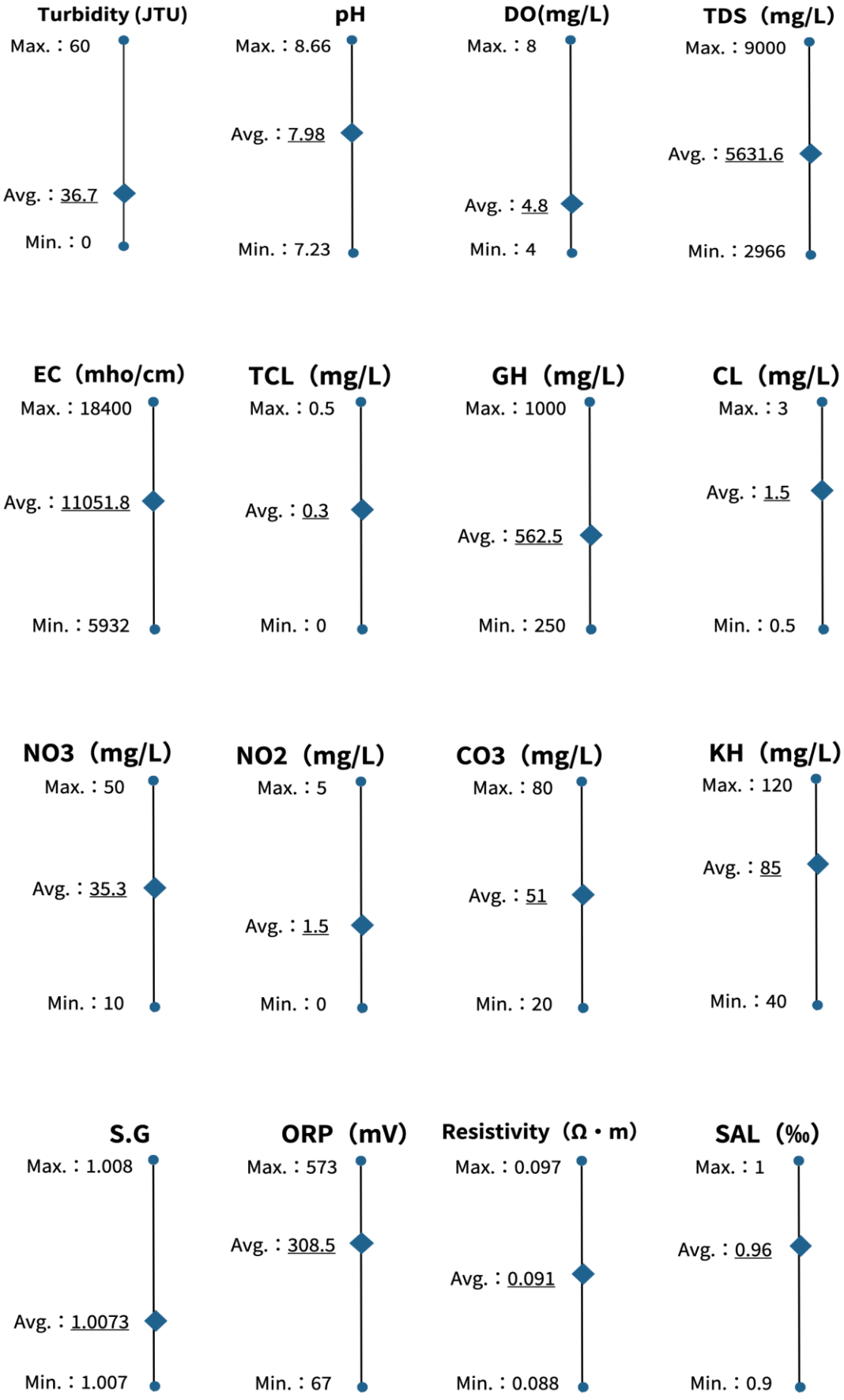
Figure 1: Sampling point bitmap

Actual measurement

Some photos of me collecting data in the wetland park.

Photos of surrounding environment

The average, maximum and minimum values of each data are drawn into a box diagram, and the basic living environment of jellyfish is analyzed.


Turbidity (JTU)
Max. : 60
Avg. : 36.7
Min. : 0
pH
Max. : 8.66
Avg. : 7.98
Min. : 7.23
DO(mg/L)
Max. : 8
Avg. : 4.8
Min. : 4
TDS （mg/L)
Max. : 9000
Avg. : 5631.6
Min. : 2966
EC （mho/cm)
Max. : 18400
Avg. : 11051.8
Min. : 5932
TCL （mg/L)
Max. : 0.5
Avg. : 0.3
Min. : 0
GH （mg/L)
Max. : 1000
Avg. : 562.5
Min. : 250
CL （mg/L)
Max. : 3
Avg. : 1.5
Min. : 0.5
NO3 （mg/L)
Max. : 50
Avg. : 35.3
Min. : 10
NO2 （mg/L)
Max. : 5
Avg. : 1.5
Min. : 0
CO3 （mg/L)
Max. : 80
Avg. : 51
Min. : 20
KH （mg/L)
Max. : 120
Avg. : 85
Min. : 40
S.G
Max. : 1.008
Avg. : 1.0073
Min. : 1.007
ORP （mV)
Max. : 573
Avg. : 308.5
Min. : 67
Resistivity （Ω • m)
Max. : 0.097
Avg. : 0.091
Min. : 0.088
SAL （‰)
Max. : 1
Avg. : 0.96
Min. : 0.9

The figure shows that according to the pH value, we know the water quality is slightly alkaline. The average of dissolved oxygen content is 4.8 mg/L, the water is medium and light polluted. The maximum and minimum values of the total dissolved solid and electrical conduc)vity vary greatly. It can be inferred that's the pollutants or suspended solids are different at each point, but there are jellyfish existed in each point in common. The aggressively hard water and the average value of nitrate and nitrite all show that the water quality is not suitable for jellyfish survival. But,there are s)ll tens of thousands of jellyfish existed in this area. It can be inferred that the fish don't need high water quality.

2. Investigate and compare the average pH value each point in jellyfish lake

There are five time periods to go to Linyuan Ocean Wetland Park for sampling. The figure 2 shows the average pH value of each point in the five time periods (rounded to the second decimal point) to make a bar graph to compare.

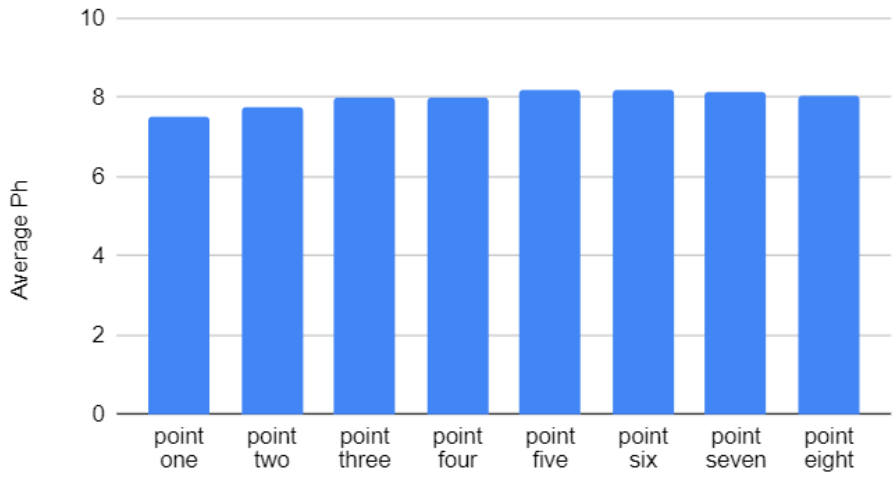


Figure 2: Comparison of average pH value at each point

The average value of point 1 is 7.52, the average value of point 2 is 7.73, the average value of point 3 is 8.01, the average value of point 4 is 8.01, the average value of point 5 is 8.19, and the average value of point 6 The value is 8.17, the average value of point 7 is 8.02, and the average value of point 8 is 8.06. It can be seen that the overall water quality is slightly alkaline, and point 5 is slightly more alkaline than other points.

3. Investigate the electrical conductivity (EC) and total solids content (TDS) of each point in jellyfish lake

Using five time periods, calculate the average electrical conductivity and total solids content of the point in water (rounded to an integer), and use the combined bar graph (Figure 3) for comparison.

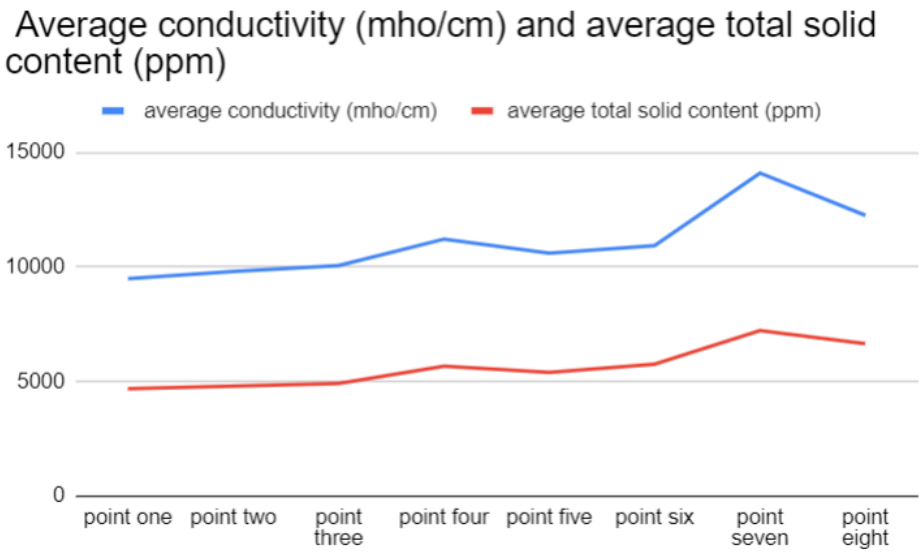


Figure 3: Comparison of average electrical conductivity (mho/cm) and average total solid content (ppm.) at each point

The average conductivity (mho/cm) value of point 1 is 9284, the average value of point 2 is 9800, the average value of point 3 is 10052, the average value of point 4 is 11212, and the average value of point 5 is 10592, the average value of point 6 is 10928, the average value of point 7 is 14096, and the average value of point 8 is 12252. The higher the value of point 7, it shows the more electrolyte content in water than other points.

The average total solid content (ppm) value of point 1 is 4681, the average value of point 2 is 4796, the average value of point 3 is 4900, the average value of point 4 is 5666, and the average value of point 5 is 5398, the average value of point 6 is 5752, the average value of point 7 is 7210, and the average value of point 8 is 6650. Similarly, the higher the value of point 7, it shows the more impurities in the water than other points.

From Figure 3, it can be deduced that the average electrical conductivity and the average total solid content in water have almost the same trend, and because there may be more solid suspended particles in the total solid content that will affect the electrolyte in the water, it can be speculated that the more electrolytes in the water, the more impurities in the water, too.

4. Community Creation and Sustainable Development

Discuss the local community creation and sustainable development of Linyuan Wetland Park:

(1) In terms of community creation, some residents will regularly go to Linyuan Wetland Park for walks and sports in the evening. It can be seen that Linyuan Wetland Park is also a good place for Linyuan people to rest. On the way to Linyuan Wetland Park, there are also graffiti about Linyuan Wetland Park the nearby walls. Those graffiti were drawn by local people. From this aspect, the community is actively cultivating and cohesive community awareness.

(2) Linyuan Wetland Park is a famous scenic spot in Linyuan District, and the pumping motors in the park meet the fourteenth and fifteenth items of the United Nations Sustainable Development Goals (SDGs), namely: conservation and sustainable use of the ocean and Marine resources to ensure sustainable development, protect, maintain and promote the sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, terminate and reverse land degradation, and curb the loss of biodiversity, so forest gardens Wetlands have a certain basis for the sustainable development of the ocean.

5. SWOT Analysis of Linyuan Ocean Wetland Park

After understanding the general water quality status of Linyuan Wetland Park and the current situation of tourism operation and management, using SWOT to analyze the strength, weakness, opportunity, and threat of Linyuan Ocean Wetland Park in terms of community construction and sustainable development in the future.

Research Conclusions and Suggestions

This research uses field measurement, literature review, data analysis, interview survey, SWOT analysis, to sort out the research conclusions and suggestions in many aspects.

1. Conclusions：

(1) Sightseeing in Linyuan Wetland Park:

It can indeed attract foreign tourists, but for the community, there is a pity that no way to improve the economic and tourism benefits

(2) About the Habitat of Jellyfish:

According to the current sampling points 1 to 6, to inferred that the water quality of Jellyfish Lake is moderately polluted, so it can be judged that Cassiopeia jellyfish does not need great requirements for water quality.

(3) Formation of Jellyfish Lake:

Linyuan Wetland Park was originally only a mangrove area, and jellyfish appeared later, but the number of jellyfish was less than now. In order to solve the problem that the low water level and high-water temperature made it difficult for organisms to survive here, non-governmental organizations provided suggestions for workers. At last, the workers department installed a pumping motor next to the flood detention pond (the jellyfish lake now) to solve the problem. The pumping motor allows the water to circulate, and the phenomenon of jellyfish surge.

(4) Community Creation and Sustainable Development:

Local residents will carry out activities here or paint public walls nearby. The researchers believe that the establishment of Linyuan Wetland Park will help to gather the awareness of community residents, because most of the commentators in the park are trained by local residents. It can let everyone have the opportunity to participate in public affairs and form civil groups to pay attention to Linyuan Wetland Park.

2. Suggestions

The results of the analysis show that although the Linyuan Wetland Park can attract tourists from other places, the overall tourism and economic benefits are still not great. These researchers suggest that the Tourism Bureau and the Labor Office cooperate to promote relevant policies. In addition, the traffic in Linyuan Wetland Park is basically foreign tourists can only choose to drive or take a bus to come here. The traffic is not very convenient. It is recommended to promote sightseeing bus during holidays and arrange travel plans for the entire forest park. It won't let tourists come to Linyuan Wetland but don't know where else to go nearby.

Literature discussion

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