causes of jellyfish blooms and their influence on marine environment.

Changfeng Qu 1,2, Jin'ning Song 1, Ning Li 1

Key Laboratory of Marine Ecology and environmental Sciences, Institute to oceanology, Chinese Academy a Sciences, Qingdao 2660 71, Shandong, our; 2 University to Chinese Academy a Sciences, Beijing 100049, i ). - Chin. J. Appl. Ecol., 2014, : 3701-3712.

Abstract: Jellyfish blooms have damaged this normal composition and function of Marine Ecosystem and ecological environ-ments, which have been One of the new Marine ecological disasters. In This study, we summarized the possible inducements of jellyfish blooms, on influences of jellyfish Blooms on biogenic elements, Dissolved oxygen, Seawater acidity and biological Community were discussed Emphatically. The results showed so Jellyfish blooms had a close Contact with its Physio logical Structure and Life history, which had favorable characteristics including Simple body structure, Rapid Growth, thriving Reproduction, short generation Interval to tolerate harsh Environment Better. Jellyfish abundance increased rapidly when it Encountere d suitable conditions. The temperature variations of seawater Might be the major inducing factor which could result in Jellyfish blooms. Jellyfish Blooms may benefit from warmer Temperature that could increase the food Availability of, Jel lyfish Then Promote jellyfish Reproduction, especially for warm temperate jellyfish species. Eutrophi cation, Cli mate Change, overfishing, alien * Invasions and Habitat modification were all Possible im portant contributory factors of Jellyfish blooms. Jellyfish could significantly influence the form Distri bution Then biogeochemical cycling of bioge- nic Elements. Jellyfish excreted NH4 + and PO4 3- at a rate of 1-91.5 ^mol N • kg^-1 • H^-1 Then 1.1-1.8 ^mol P • kg^-1 • h^-1, which could meet A bout 8 % -10% and 21.6% of P hytoplankton primary Production requirement of N and P, respectively. Live jellyfish released dissolved organic carbon (DOC) at a rate of 1.0 ^ mol C • g^-1 • d as jellyfish decomposing, this effluxes of of Total N and Total Pwere 4000 ^ mol N • kg^-1 • and, ^ Mol P • kg^-1 • d^-1, respectively, the efflux of DOC reached ^mol C • G^-1 • D^-1. Jellyfish decomposition could cause Seawateracidification and lowered level of dissolved Oxy Gen Then finally made the ambient Water become Acidic Then hypoxic. The pH decreased by 1.3, while This Meandisolved Oxygen demand reached . 8 ^ mol • kg^-1 • H^-1. Jellyfish blooms also in influenced This Marine organism Community, which might reduce " Biomass of Some fish and Zoo Plankton, Increase , amount to Bacteriop lankton, indirectly increase this quantity of of phytoplankton and lead to Abnormal primaryProduction .

Keywords: inducement; effect; jellyfish accumulation; seawater temperature; Marine Ecos -envi ronment.

1.Introduction

Jellyfish are an important part of marine life, in zooplankton The community plays an important role. In recent years, jellyfish Wanza frequency in full Ball range significantly increased, the area where jellyfish Wanza has been confirmed to have China's Bohai Sea, Yellow Sea and North East Sea, and Japan Sea etc Asia Sea field 1, Spain, Mediterranean coast of Israel, etc. 2, Oman Bay, Wave Bay etc Arabian Sea Coast

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H, Irish Sea, Scotland North too Ping Yang, and northeast of Atlantic Ocean, etc. Jellyfish Wanfa The huge loss caused by is common throughout the world. reduction to reduce zooplankton and fishes, Reduce fishery production, like Black Sea jelly (meeophysis leidyi) invasion resulted in its anchovies the the crash; jellyfish Wanfa also crack nets, Damage Fishing gear, affects playing Salvage Job, like Gulf Coast North Pearl Jellyfish (Phyllorhiza punc- Tata) Wanfa damage to Nets, produces a local shrimp harvest Direct economic impact, causes approximately 1000 million loss; Watermer can block power station, nuclear power station, desalination plant and chemical plant cycle Water inlet, Force device off, as Sea Moon jellyfish (Aurila auri-ta jinva US Florida Gulf cause nuclear power plant shutdown; and , jellyfish sting even sting dead tourist, for personal security and life Into a loss, emit foul stench when dying from decay, affects water quality security. Visible, jellyfish Wanfa to human activity and the marine ecosystem. Threat, can lead directly or indirectly to marine biogeochemical processes and Changes to the marine food chain, to marine fishery, Coastal Industry, Tourism and ship navigation and other major damage, Impact on social and economic development, already is treated as New Marine Ecological Disasters.

The study of jellyfish Wanfa has become a marine ecology of the Research hotspots, This system summarizes the possible induction of jellyfish Wanfa effects of WANFA and jellyfish on marine ecological environment, focus on may cause the jellyfish WANFA marine environmental factors and human activities because of Vegetarian jellyfish Wanfa elements in seawater, dissolved oxygen, pH and effects of marine Communities, and the main lure leading to jellyfish WANFA for Preliminary evaluation, In order to study the jellyfish WANFA mechanism of the system provide rationale, provides the basis for prevention and control of jellyfish Wanfa info.

Possible triggers for jellyfish Wanfa

Jellyfish Growth, breed, The aggregation was originally Natural Phenomena, due to the natural pulsation of the jellyfish life cycle, The jellyfish will be in some specific A sharp increase in the number of sea areas or specific seasons, jellyfish number has law fluctuations cause jellyfish to cycle Wanfa, In addition to this basic season section drives the number of changes caused by the lifecycle, Eco-Environment changes can also increase the number of jellyfish. Especially in recent years with increase in human influence, Marine Ecological environment changes dramatically, jellyfish WANFA has become a symptom of the evolution of marine ecosystems, to humans Production, The economy and marine ecosystems have had a severe impact. Jellyfish WANFA reason has become a hot issue in marine ecology Research, subject to full [ ] High priority for coastal States, currently causes the number of jellyfish in the global sea area Increase and WANFA direct cause, Not enough evidence to be clarified, But the researchers speculate that many of the more plausible explanations for the,, are mostly caused by jellyfish Wanfa, to Medusa-Mong launch to Fixed promotion, not jellyfish Wanfa required conditions, and Jellyfish Wanfa cannot be explained only for a specific reason, can be a synergistic effect of various factors. This article on the predecessors of the research Summary results, The factors that affect jellyfish Wanfa have the following.

1.1 The physiological structure and life history of jellyfish

The rapid increase in the number of jellyfish is a common feature of jellyfish populations, is the early evolutionary feature of jellyfish. The Wanfa of the jellyfish and its own Physiological Reproduction has an important relationship. First, jellyfish body structure simple single, growth faster, is a low energy density population. Jellyfish exist In Low energy food chain, with very small plankton (giardia) and Micro plankton for Food Basics, This is based on Giardia The low energy food chain helps increase the number of jellyfish; low level of jellyfish The Metabolic System makes its total biomass significantly higher than the high metabolism Consumption of other marine animals. For example, compared to biological predators (Fish and whales, jellyfish lower energy requirements and faster life cycles causes a rapid increase in its biomass, Over fish and whales. Total biomass M. Second, jellyfish have a wide range of predators, Predator Class rich, natural Enemies
less, Anti-bad environment. Jellyfish mainly in zooplankton, roe and fish larvae for food. When food is restricted, jellyfish no dying now the, can be reduced by narrowing the body, to reduce the appearance of food uptake, increase chance of survival. When food can grow again; jellyfish can also eat in turbid water.

Jellyfish life history complex, Have sex - asexual generation alternate breeding special sex, make it highly fertile, generation interval short, in Bad environment live under, multiply in a fit environment cause WANFA. Jellyfish with Sex-producing Hydra →, Hydra-Body produces new water through asexual reproduction teman body or butterfly larvae, Butterfly larvae develop into new water matrix. Visible, Hydra Phase is a critical phase of jellyfish Wanfa, jellyfish Wanfa is water Teman response to environmental variability, is a survival strategy for jellyfish \( M [I] [**] () \). The Wanfa of the jellyfish population depends on the number of HYDRA bodies and the outside world ambient stimulus, satisfies the length and filling of the reproductive time of the Hyda feed time, jellyfish can occur Wanfa, at the same time, The Hydra body is not Good environment hibernate, Rapid propagation after environment recovery, is jellyfish quantity dramatically increased major reason.

1.2 Marine Environment Factor

The number and scale of jellyfish Wanfa are influenced by marine environmental factors ring, Change in marine environment is a direct inducement for jellyfish Wanfa element. Jellyfish can perceive physical gradients in the marine environment, such as lighting, Gravity, temperature, Salinity, pressure and turbulence, can also be a chemical ring for seawater changes to the environment. For example oxygen, acidity, etc.

1.2.1 Light intensity The jellyfish's sensory body can sense the

Light, to provide information on jellyfish identification, So the effect of the day-night cycle of light jellyfish distribution. Many jellyfish have vertical migration around the clock. Jellyfish The diurnal vertical migration of the causes them to float at night to the surface of the body of water, sink to bottom during day \( M \). illumination intensity can affect jellyfish clones colonization rate, appropriate illumination for jellyfish Teman survival, promote Temanbody's growth scope, jellyfish butterfly larvae in total asexual reproduction in (bud and butterfly larvae) the proportion of increases with illumination intensity and, light intensity significantly affects part of jellyfish's transverse reproduction, appropriate illumination to white Chardonnay (cynnea nozakii) Teman-born long, Teman-like foot sac, cell propagation and transverse reproduction are promoted as with, light or completely no lighting conditions not suitable for white Chardonnay Teman body grows and can cause cleft reproduction delay or inhibition \( M \). opposite, Full No light conditions can also promote jellyfish's transverse reproduction, such as sea Moon jellyfish in Dark conditions 94.8% The Hydra body occurs across the reproductive, light the Conditions only 30%; at the same time, The butterfly produced by the Hydra body in the Darkness larvae are in lighting 8 times \( $^6$ \).

Shows, The sea surface of the strong light condition is unsuitable for jellyfish Teman to grow reproduction, jellyfish floating on sea surface WANFA not Jellyfish's initial WANFA location, maybe The jellyfish are clustered again or jellyfish area redistribution, For different jellyfish under dark conditions with a different. so, Illumination is an inducement of jellyfish Wanfa, under light, jellyfish can reproduce, Growth, reaches Wanfa requirements.

1.2. 2 temperature Seawater temperature directly affects the

number and division of Jellyfish cloth, different jellyfish have different temperature preferences, can be divided into warm jellyfish, like China's East Yellow Sea Chardonnay (cynnea sp.); Tropical Jellyfish, as Fair jellyfish (cassiope ea xamachana) and nitrate jellyfish (masti - Gias sp.); cold-temperate jellyfish, such as the side wrist jellyfish in South Africa (Pleuro - Brachia pileus); Wide-temperature jellyfish, such as the Sand Sea Temporary (nomopilema Nomurai). So different temperature jellyfish have different distributions, temperature fluctuations in the degree may result in changes in jellyfish distribution and quantity. Most warm jellyfish in warm year abundance increase \( ^{51^2} \), A handful of water mother appears in colder years, clustered at low temperature. Seawater warming to increase the water layer hierarchy, Cause increased volume
of giardia, "The Best for You" The potential food chain helps jellyfish grow M; warming The sea can increase the temperature warm jellyfish biomass, make it winter under advantage, with longer More productive reproduction season increases quantity. West Mediterranean and northeast large The Wanfa of the western jellyfish and the warming of the sea water and the surface of the seawater have the the off 66; Global warming and sea temperature rise potentially promotes the Yue-Ben Sea Moon jellyfish Wanfa; Interannual variability of jellyfish in the North Atlantic and temperature change about, Sea surface temperature and jellyfish abundance are positive close M. opposite, Tropical Jellyfish number on the increase in temperature reduce u, Some jellyfish also benefit from unusually low temperatures.

temperature can also affect the asexual rate of jellyfish M, and asexual The process of reproductive production of bud and jellyfish larvae determines the number of jellyfish. The effect of seawater temperature on jellyfish reproduction is bidirectional, Warm temperatures can promote Cross-splitting reproduction of jellyfish and the reproduction rate of the Hydra, also increases larva death rate; High temperature inhibits the budding reproduction of jellyfish; low temperature can cause water female split reproduction, Increase jellyfish sprout reproduction. for most warm water mother, warm temperature promotes jellyfish breeding, Increase the number of jellyfish by, such as a certain range the sea Moon jellyfish butterfly larvae in total asexual reproduction The ratio increases with the increase in temperature, warm warm promote sea Moon Jellyfish's Cross-cleft reproduction, increase the daily output of the butterfly larvae, and high temperatures cause the sea Monthly jellyfish survival reduction, Low temperature transverse cleft reproduction does not appear M; Sea Sand The cross-splitting reproduction of the sting increases with increasing temperature M; Comb-like jelly (mneniopsis leidyi) spawning volume increased significantly at warm temperatures, Five volume Golden Thorn jellyfish (Chrysaora) The spawning rates for the QUINQUECIRRHA Warm colder temperature high M.

To summarize, temperature changes can affect jellyfish abundance, Change its distribution area and time length, appropriate temperature to increase jellyfish's food, promoting jellyfish clones - sexual reproduction, causes jellyfish to gather; temperature degrees are changing parameters in the marine environment, seawater warming has become the inevitable trend under the influence of global warming. for widely distributed warm temperatures sex jellyfish "", water heating makes it more likely to multiply mass, form jellyfish Wanfa, So seawater warming may be the current jellyfish Wanfa Most direct inducement factor.

1.2.3 salt jellyfish differ in salt preferences, causes different salts The jellyfish in the concentration waters have different distributions, salt fluctuation make water parent distribution changes with quantity. Common Wanfa in Chinese yellow jellyfish jelly jellyfish, xia jellyfish, Multi-tube jellyfish (Aequorea spp.), Sea The most appropriate salinity for the jellyfish appears as 32 ~33, 32 ~ 34, 33, ~34 127. salt or affect the jellyfish asexual rate The inappropriate salinity conditions for the important factors of the will cause the water matrix stop production, High salinity can significantly reduce the water mother's Bud ratio Example M. Five rolls of golden thorn jellyfish number of asexual reproduction and partitioning by to the significant effect of salt, Salt range for jellyfish appears as 5 ~25, at low salinity, Although the Hydra can appear but will not produce a wave young boy 129; Bud Tube Jellyfish (Proboscidactyla ornata) asexual Reproduction also affected by salinity M; salinity to white Chardonnay Teman-like body's survival, growth and transverse reproduction and sphenoid larvae survival, growth all affected, White Chardonnay teman and larvae survival salt degree The , lower bound are 35, 12.5 and 35, Optimum salinity for ~32.5 and ~35 to. Visible, The appropriate salt condition can be enough to promote jellyfish reproduction and growth, make jellyfish Wanfa possible. 1.2.4 Low-oxygen / hypoxia condition low oxygen / anoxic Environment can change the sea Ocean Living life, ingestion, growth, Breeding and distribution, to affect the sea Ocean food chain. Low-oxygen / The presence of anoxic environment provides a for jellyfish Wanfa favorable conditions. This is because jellyfish are more tolerant than other marine fish. and adapting to low oxygen / anoxic Environment; and the low oxygen tolerance of jellyfish
fish is Force low, Low Oxygen / may die or escape from anoxic environment; Water mother feeding fish larvae low oxygen tolerance, in low oxygen / anoxic environment Both the reaction and the ability to escape are weakened; vulnerable to jellyfish predation; and baby jellyfish body, Low-oxygen-resistant Hydra also higher, can be in low oxygen / anoxic ring "" for asexual reproduction. After the increase in oxygen content can be done with the sexual reproduction.

The physiological mechanism of the jellyfish allows it to be in the hypoxic / Save in the anoxic environment Live, High tolerance for hypoxia, can be used both to regulate oxygen through aerobic metabolism gas, Minimize the harm of hypoxia; The can also be stored in jellyfish colloid oxygen consumption in supports oxygen depletion in low oxygen conditions; simultaneous, Low oxygen / anoxic environment kills or escapes other marine life, Add jellyfish living space, to provide favorable conditions for the growth and reproduction of jellyfish. jellyfish can enough to tolerate dissolved oxygen (do) concentration, 1 mg • L⁻¹. Many predatory water mother and fish that compete for food with jellyfish low oxygen tolerance, Fish on do concentrations of 2 ~3 mg. L⁻¹ With escape or death Triple. Five tendrils of golden thorn jellyfish and comb-like jellyfish in the Chesapeake Bay in the Do-concentration 1.0 mg. L⁻¹ can all survive, Foot-scratching animal and fish larvae to low oxygen / anoxic environment more sensitive; do concentration is 1.5 mg • L⁻¹, jellyfish are not affected by predators of foot-scratching animals ring; To reduce the predation rate of other finfish species by Do concentration (Low to 0.5 mg • L⁻¹) predation rate remains unchanged or increased. Sea Moon jellyfish in Do concentration 2 mg • L⁻¹, No change to the ring rate change, No decrease in predation of eggs, more than Spanish mackerel (Scomber- morus Niphonius) more resistant to hypoxia, jellyfish in low oxygen / anoxic Ring To perform normal asexual reproduction, Jellyfish larvae can also survive in low oxygen /, anoxic environments, such as the Hydra of five rolls of golden Thorn jellyfishenough to / survive and clone in hypoxia/anoxic environment, at moderate low oxygen (< 1.5 mg • L⁻¹) The duration of the condition is up to D, under extremely low oxygen conditions (0. 5 mg • L⁻¹) to survive at least 5 D; Low-oxygen / anoxic Environment Sea Moon jellyfish Hydra Normal physical health save, growth and reproduction, jellyfish Hydra in do concentration 2. 0 and 4.0 mg L⁻¹ all surviving and asexual reproduction under creates a new Hydra, but Do concentration is 2. 0 mg • L⁻¹ cannot split reproduction Create floating larvae, and in extremely low oxygen environment (0. 2 mg • L⁻¹) hydra body in 7 d all deaths in M.

Low-density Do has less effect on jellyfish asexual reproduction, Jellyfish Hydra can survive and clone in low oxygen / anoxic Environment colonization, Increase Hydra body number, with Do increased concentration, Hydra Body transverse genital generation butterfly larvae. This could be a sudden increase in the number of jellyfish One important reason for is. Low-oxygen / anoxic environment is jellyfish Wanfa and _ Important inducing factor, Although the jellyfish will not appear low Do concentrationArea move behavior, But when jellyfish mass multiply in low oxygen / anoxic zone when, low oxygen conditions have little effect on the survival and reproduction of jellyfish, but affects jellyfish Predators and arrested people, due to lack of predators and food relative increase, make jellyfish Wanfa possible.

1.3 Anthropogenic impact factor

because of the impact of human activity, Large changes to the marine environment format. Many researchers speculate that, human activity may have tribute to jellyfish Wanfa offer, Increase the number of jellyfish to some extent, jellyfish number Changes can reflect changes in the global marine system mediated by humans or the disturbance. The man-made factors that affect the increase in the number of jellyfish include: water Body eutrophication, climate change, Transition Fishing, alien species invasion and sea on-shore makeover, But there's no direct evidence that these people factor is the direct cause of jellyfish Wanfa, Or has directly caused Wanfa jellyfish phenomenon, only inferred from statistical analysis, Human Live move may be the inducement factor for jellyfish Wanfa, human disturbances may affect jellyfish Abundance.
1.3.1 Eutrophication of the water body is considered to be a marine birth State System Most serious problem many scientists think that the sea the Shifu Nutrition is the main contribution of jellyfish increase and Wanfa because of the child 137. A of nutrients and turbidity caused by eutrophication increases and changes in seawater chemical properties can lead to jellyfish uptake.

The dissolved organic matter of increases, and indirectly increasing phytoplankton, make oxygen and lighting reduction, affect jellyfish diversity and biomass.

jellyfish have a special ability to adapt to a eutrophic environment, water Body The effects of eutrophication on jellyfish include the following aspects: First, RichNutrition by increasing phytoplankton cause body of water do low concentration, and jellyfish have high tolerance for hypoxia. the surface of the body of water with a nutrient-rich condition contains Oxygen Rich, so near surface life camp planktonic jellyfish, like clock jellyfish ( Aglantha digitale,) four-leaf small tongue jellyfish ( liriope tetophyl - la ) / Five-point jellyfish ( Muggiaea atlantica) and shallow room jellyfish (Len- sia spp.) can survive 138, Other jellyfish have at least one growth phase to survive in hypoxic or even anaerobic environments. Japan eutrophication worst Sea area _ Tokyo Bay, low-oxygen caused by eutrophication The addition of the Sea-Moon jellyfish Hydra and the growth of the sea-moon jellyfish in the context of the "" Direct contribution 3]. Second, nitrogen and phosphorus nutrients in eutrophic water is closely related to jellyfish density, Excessive load of nutrients can cause jellyfish Wanfa, increase of nitrogen and phosphorus in eutrophic water, to causes plankton increase, provide food for Hydra body and water matrix object Support, providing energy for jellyfish. Third, eutrophication can cause food chain complex changes, Change the prey type and species of jellyfish, By eutrophication caused by the Tokyo Bay Sea Moon jellyfish prey mainly to the like a Small copepods oithona davisea increase, Increase plus the chance of a sea-moon jellyfish to appear in large numbers 1. also, eutrophication also causes light to decrease, Cause jellyfish to redistribute on the area, benefit jellyfish Wanfa.

1.3.2 overfishing of humans to fish, Crustaceans, the past of algae, etc. Transit development leads to disturbances to coastal ecosystems, make ocean Community structure changes of fishery resources, Advantages of fishery resources "" from underwater species of high value to low-value deep-sea species transition. jellyfish are part of the marine food chain, jellyfish with fish and floats There is a strong interaction between the creatures, jellyfish can hunt zooplankton and fish eggs and larvae, And can be planktonic fish, predation, Form feedback loop, If feedback loop appears corrupted, It may be now jellyfish Wanfa, Therefore, overfishing of fishery resources destroys the sea foreign food chain, make trophic level drop, cause the number of jellyfish to increase plus 441. such as the East China Sea album ( psenopsis anomala ) increase has negative effects on large jellyfish, Jellyfish increase is also negative for the fish affect, Therefore, the overfishing of the fish will result in positive effects on the jellyfish. ring, The, in turn, causes a more negative impact on the effects of the larger, To cause the more positive effects on jellyfish 1. This feedback loop will cause the jellyfish Wanfa.

overfishing reduces jellyfish predators by , A jellyfish-eating marine animals including 124 species fishes and % Other Animals 1- the . rhombus Turtle ( Dermochelys coriacea ) as the main prey of jellyfish people [+], Current number is decreasing . fish with jellyfish as a package Include many economic fishes, like salmon ( Oncorhynchus keta,) Edit Fish, feedback fish (scomber scombrus) and white spot shark (squalus acantbias) 133, + ], Large-volume fishing of economic fishes, makes the jellyfish's Fewer predators. increase in sea-moon jellyfish in the Black Sea and the mackerel Decrease about 7]; Luminous jellyfish in the Adriatic Sea ( Pelagia Noctiluca) increase with some predatory jellyfish fish in the transition fishing about ( + ; Transitional Fishing in the East China Sea has resulted in the nutritional level of fisheries Severe descent, increase in fishing for increased number of "fish ", reduces jellyfish predators, increases the likelihood of jellyfish Wanfa 1 All.

overfishing reduces the jellyfish's competitors, jellyfish with planktonic Animal Food for food Fish competition
Foods, For example anchovies, Herring, Sardines etc all, by comparing the jellyfish with the bait fish Diet hair. Now, Both Foods have 0.2%~73.4% are overlapping [3]. Caspian Sea: The jellyfish and the anchovies have the 84%~89% overlap. Logically speaking, the decrease in fish-eating fish increased the number. But humans are fishing for small bait fish. Clear jellyfish competitor reduces the potential predators of jellyfish. To make zooplankton eat jellyfish. Increase such as the reduction of zooplankton-like fish in the Bay of Myanmar less cause tube jellyfish (nanomia caur) increase [all]; Irish Sea: An important economic fishery the overfishing of herring caused the jellyfish to increase plus. Part of the reason for the Wanfa of the Black Sea comb jelly is also caused by the transition Fishing-triggered.

1.3. Climate Change climate cycle impacts marine productivity. Climate change can cause instability in marine ecosystems, number of jellyfish is related to climate indicators but the rendering process varies by region. to Jellyfish: The number of climate indicators that have a direct impact include: sea surface temperature (SST), North Atlantic Oscillation (NAO), North Pacific Decade Oscillation and El Niño (El Niño) events etc; rainfall can also be increased by adding rivers runoff to increase nutrient inflow, thereby indirectly affect jellyfish quantity. Climate other marine environment changes caused by changes also affect the jellyfish's quantity and distribution, like seawater acidification. Purcell through long time to Analysis of jellyfish population trends, on interannual scale, jellyfish rich changes with climate. In Irish Sea, jellyfish Abundance and climate index Strong consistency, climate index (NAO, SST and precipitation) can explain % Annual variability of jellyfish abundance.

Climate Change causes climate variability, affects jellyfish count and divide by cloth. Jellyfish are sensitive to climate variability, jellyfish Abundance and large climate Index related to. NAO is a way to help the North Atlantic, North Sea and Euro Climate change climate phenomenon in continents, affect ocean and terrestrial life State system. It causes climate change that can affect jellyfish abundance. North Sea North-Western jellyfish abundance and North Atlantic Oscillation Index (NAO) with positively related; jellyfish Abundance in northern Denmark west of the North Sea and east of Scotland with naoi show significant negative correlation; South East Sea in low naoiperiod Special don't be seawater temperature cold jellyfish abundance increase. El Niño: The event can affect the ocean jellyfish by a series of physical ocean phenomena, distribution, abundance, growth and reproduction, 1991-1992 and 1997-1998.

The two El Niño for appears mitrocoma cellularia jellyfish number of sudden increase and Colobonema sericeum jellyfish vertical points cloth decrease.

1.3. 4 Invasive alien species invasion caused by human activity species invasion creates huge pressure on the ocean's planktonic food chain, affect biodiversity of marine ecosystems. Many jellyfish Wanfa phenomenon The jellyfish species of the are all new species brought in from the field. For local fisheries and the destructive effects of marine ecology. These exotic jellyfish species one Dan enters a new area, encounters an appropriate environment, at the appropriate temperature and sufficient food, missing predators and competitors, number will increase rapidly plus, at the same time, because jellyfish grow quickly, and features such as asexual provides the basis for its intrusion, and the jellyfish themselves (form plasticity, Transparent concealment, and so on) makes it difficult to at the beginning of the intrusion Discovery, so invasive alien species may be the most dangerous jellyfish. Send type. A human-assisted species is brought into the main source of the jellyfish invasion. Due to, the bringing of exotic jellyfish is mainly through shipping traffic, Fishery Trade and ship's ballast water exchange and sewage discharge, make jellyfish go through then ocean Barrier enters new sea area, Which takes the ballast water as the medium of The intrusion is only suitable for the full battalion phytoplankton the comb jellyfish, pot jellyfish and Hydra. The life history of jellyfish includes the attachment of Hydra phase, easier to pass by ship body sewage discharges into.

The worst consequence of the jellyfish invasion is the century beginning of the year Comb-like jellyfish intrusion, cause black and Azov anchovy number of sharp reductions, to % total biomass of jellyfish in the Black Sea at the end of the decade Ten8~7 x Ten8 t. They are planktonic crustaceans, Mollusk larva, planktonic eggs and fish.
larvae for food, compete with economic fish for food Objects, changing planktonic community structure, reduces the number of planktonic and fish species amount, causing havoc on Black Sea ecosystems, makes a significant local economic loss. Comb-like jellyfish enter the Black Sea after the intrusion scope expands, including Mediterranean, Caspian Sea, North Sea, and Baltic Sea Seas, causing the collapse of many commercial fisheries around the invading seas break and ecosystem destruction. From Southeast Asia and Australia, blob jellyfish (Phyllorhiza punctata) invade Gulf of Mexico, causing permanent ecological change, for Fishery Enterprises big losses. Because of the flow and ships carrying primarily distributed in the western Indian Ocean and Arabian Sea day grass jellyfish (sanderia malayensis) in Long River mouth Wanfa, 98.4% for total catches, for the Changjiang estuary Fishery resources bring devastating losses Before.

1.3.5 habitat change jellyfish early development phase (Hydra)

Body, float larva) play an important role in jellyfish life history, is jellyfish-flourishing Key impact factors for many jellyfish's Hydra body for battalion Living, required hard matrix, Sea level due to climate change rise, coastal zone caused by increased population and increased human energy requirements Reclamation. Increase in building and aquaculture etc. Provide more attachment matrix for jellyfish Hydra body and appropriate Breeding Environment. The number of artificial buildings currently in the 3.7% ~ 28.3% increases the speed of; The energy industry also supplies the jellyfish with a on surface, including oil rig, Power station cooling water system and offshore wind Force, tides, Water Wave power Plant, where wind energy expands to every year 28.3% M. Compared to the natural matrix, jellyfish Hydra prefers coagulation soil, processed wood, artificial matrix such as polyethylene and glass, artificial matrix Increase extending the region distribution of jellyfish Hydra. Coastal Habitats Changes in the number of jellyfish causes a corresponding change in the amount of Jelly attachment Matrix Increase in the number of causes the jellyfish to multiply in the benthic stage. is The key factors that affect the number and distribution of jellyfish are

Hydra of five tendrils of the Gulf of Mexico and Sea Moon jellyfish Body for battalion attachment Life. The Gulf of Mexico has a large number of hard matrices, includes Natural Oyster reefs, manually placed buildings such as oil and gas production set, artificial reefs etc., provides a chance for the Hydra body to attach to the deep sea, The number of jellyfish Hydra can increase rapidly under appropriate conditions. jap household Inland Sea-month jellyfish number on 1982-2002 years increase. This is related to the change of the coastal zone to increase the Hydra attachment. Taiwan Big Sea raft for the aquaculture in Peng Wan, for the moon Jellyfish Hydra Group shape The attachment of larvae to provide the matrix, Added jellyfish number. Yellow, Extensive use of Bohai aquaculture to coastal areas, also for jellyfish reproduction provides a large number of new habitats, Compared to other sea areas, yellow, the sea coast Sea Moon jellyfish and white Chardonnay frequent WANFA.

2. effects of jellyfish Wanfa on marine ecosystems

The effects of jellyfish on marine ecosystems are summed up mainly in the Two aspects: impact on marine environment and impacts on marine life (diagram 1). A large number of jellyfish gather to bring in the ingredients of the jellyfish, morphological changes and transitions, as a repository of nutrients to the sea release; aggregated jellyfish consume more oxygen, causes partial hypoxia or even a lack of Oxygen Zone, and affect oxygen consumption and microbial health of other marine organisms long propagate; jellyfish gather to occupy a certain ocean space, causes other fish to class and phytoplankton living space reduction, jellyfish prey floating things and eggs and fish larvae, Is the predator of other marine life and the competitor, Jellyfish Wanfa initially destroy the ecosystem's planktonic path. The jellyfish Wanfa with the jellyfish's death. Jellyfish Wanfa only Last days or weeks, then jellyfish start sinking and death breaks down, can be Changes of content and morphological distribution of source elements in aqueous matrix, also can consume oxygen, forms a low-oxygen / Anaerobic Zone, affects acid and alkali environment in water body. Jellyfish Change the ocean by its impact on the marine environment and marine life structure and
function of ecosystems, can even cause other marine disaster occurrence, for example eutrophication, and algal blooms and other marine objects.

2.1 effects of jellyfish WANFA on the marine environment 2.1.1 effects on students’ factors jellyfish in the source factor cycle plays an important role, mass changes before and after jellyfish Wanfa, can enough affect marine ecosystems C, N, P Loop, is the source element into Row area moving media, also source elements in the ocean food chain loop path. jellyfish can ingest dissolved organic matter through predation and get C, N, P, can also be through body mucus, excrement and water mother Body decomposition release organic matter to water and inorganic N, P, make C, N, P Reborn, so jellyfish Wanfa form nutrient repositories, to the ocean C, N, the loop for P the has a significant effect. jellyfish sink faster, Eliminate decay occurs more in seawater - Redundancy Interface, Wanfa area versus extinction area is different, So jellyfish Wanfa can cause the source element to occur in the form of Transformation of State and position transfer, except for increasing the source elements in seawater Quantity, can also flow into sediments, Increase the number of students in sediments. Water The element cycle caused by the parent population has potential for phytoplankton and bacteria. affect, The inorganic nutrients emitted by jellyfish can be used for phytoplankton primary production provide N, P, The dissolved organic matter discharged by can support the planktonic bacteria's production. so, The jellyfish swarm is when jellyfish Wanfa - A huge source of students to Vegetarian Source, affect seawater and sediments C, P content, form and distribute.

jellyfish regeneration of a large amount of nutrients can significantly change the seawater environment and the sea dynamic of nutrients in the bottom sediments of. The inorganic nutrients released by the jellyfish are Primary production of phytoplankton provides a small but important part, horse Buck jellyfish (catostylus mosaicus) NH₄ + and - e³ Row The drop rate is ? l ~ S 5 pmol N • kg⁻¹ • H⁻¹ 1.1 ~1.8 pmol P • kg⁻¹ • H⁻¹ . Japanese Inland Sea Sea Month jellyfish NH₄ + and PO₄³⁻ - The excretion rate of is 0 . 497mₑców¹⁰⁹ pmol N • Ind⁻¹ • D⁻¹ (mₑcow: wet mass, ind: every only) and 0.453 mₑcow . S pmol P • ind⁻¹ • D⁻¹, is equivalent to Phytoplankton

Jellyfish can change the cyclic path of dissolved organic carbon in seawater. Water mother as the circulating media for organic carbon, through predation on zooplankton, To transfer the carbon from primary producers to fixed secondary producers in seawater to the water matrix, release of the jellyfish when they are drained and decayed with Machine material, planktonic bacteria consumption, Increases the carbon metabolism of bacteria, make "" (The carbon flows into the bacterial community, the particles produced by the jellyfish decay have a "" mass deposition to seabed, increases the amount of carbon in the sediments. Live jellyfish dissolve The release rate of organic carbon is up to 0.6 ~ 1.3 pmol C • G⁻¹ • D⁻¹, is approximately 1.0 pmol C • g⁻¹ • d⁻¹m, the release rate of the death jellyfish is a live jellyfish's times, up to [ ] pmol C • G⁻¹

• D⁻¹, The jellyfish sink and rot to sink near the sediments C [ ] Contribute up to (47333 ± 7000) pmol C • m⁻²m. jellyfish-flourishing Send a change to the cycle of carbon : the part of the carbon dissolved in seawater, participate in the sea various loops in water; The section leaves the advanced nutrition level, to fine The metabolism of the bacterium, cause changes in food chain and biological structure; also There is a portion of granular carbon flowing into the sediments, carbon-causing biological land ball chemical function changed.

2.1. 2 effects on oxygen in seawater as described above, Low-oxygen ring borders provide favorable conditions for jellyfish Wanfa, Jellyfish's low oxygen Ability to be stronger than other marine fishes, to survive in a hypoxic environment; Reverse Come jellyfish Wanfa has positive feedback on the presence of hypoxia. First First large-scale jellyfish aggregation itself increases in oxygen consumption, make dissolved oxygen in seawater concentration significantly lower, Local hypoxia in jellyfish accumulation area; jellyfish death after, The nutrients in the jellyfish are released to the water body, intensifies microbial activity, Increase oxygen consumption; reduction of dissolved oxygen in water can cause other low tolerance Oxygen Bio-Death, forming a ripple effect, increases dissolved oxygen consumption, Forms Large-scale low-oxygen / anaerobic zone; jellyfish feed on zooplankton, reduce Food intake of
zoo plankton to phytoplankton, make more phytoplankton into the seabeed and rot, Phosphate and ammonium salts released by anaerobic sediments provide nutrients for phytoplankton, adds a low oxygen circulation \(^4\); at the same time, impermeable colloidal debris leads to reduced oxygen flow into sediments \(^5\), causes local low oxygen or anaerobic environments on the seafloor.

Jellyfish Wanfa especially after Wanfa decay on the ocean environment Oxygen changes in gas have important effects, can cause dissolved oxygen concentrations in seawater Significant continuous decrease, such as, maximum deposition of mosaic jellyfish when they decay oxygen consumption up to \((6161 \pm 3422)\) pmol \(\cdot\) m\(^{-2}\) \(\cdot\) H\(^{-1}\)-no, water mother Water 9 times, average deposition of oxygen consumption is greater than no jellyfish water \(209%\). The average oxygen consumption in the process of rotting jellyfish is up to 32.8 \(\cdot\) mo bu kg\(^{-1}\) \(\cdot\) H\(^{-1}\), water saturation is only 8.3% ~ 13.3%. at the same time, The nutrients produced by the jellyfish decay can be increased by fine Microbial biomass and growth rate, can significantly increase oxygen consumption. The low oxygen environment caused by jellyfish WANFA can cause other non-aerobic chain death, aggravating oxygen consumption, Increase low Oxygen-Free Zone, affect the survival, reproduction and diversity of marine life, break bad marine ecosystem species composition and Food Network, Affect marine health The state system features and stability, another, Water dissolved oxygen consumption can be increased by Plus sea salt - dissolved oxygen gradient of atmospheric interface, promote oxygen in the atmosphere dissolve in seawater.

2.1.3 influence on ph of sea jellyfish WANFA to seawater PH The effect of the is mainly on the body of the jellyfish when they perish. PH Change. jellyfish accumulate a large amount of decay and produce a transient acidic environment, water Body in pH Quick Decrease, Decrease to 1.3 units ; with water decomposition of the mother, acidic environment eased, water pH recover, when the water matrix is completely decomposed, the body of the PH Keep Stable, can eventually be guaranteed on \(7.2 \sim 7.6\), but still less than before the water matrix rots. water Body PH a sharp drop in may be due to the presence of a large number of proteins in the water matrix, in the role of microorganisms, decompose into a large number of amino acid states; water Matrix Organic matter in the can also be converted into a "" in the process of decomposing the jellyfish Other acidic substances, Increase water acidity; and the multiplication of planktonic microorganisms colonization can also cause water acidification. is gradually decomposed with the water matrix, Ammonia Base acid is decomposed to ammonium nitrogen, Other acidic organic matter by microorganisms burn out, The number of microorganisms after the depletion of maternal nutrients in the water is reduced, make ] Water Body PH incrementally increase, until the jellyfish decomposes completely because some dissolve Solution Organic acid not consumed completely, So the water is still acidic. also, Seawater temperature reduction, increased acidity and decreased salinity will cause The Water is more acidic when it decomposes and rots. \(^{68}\).

The acidification of seawater produced by Jellyfish Wanfa has a regional and brief sex, main from jellyfish decay start, focused on jellyfish mass aggregation sink area. This instantaneous regional acidification phenomenon can affect the region Biological activity and existence of certain substances in seawater, change its strong degrees and distributions, affect material availability to affect sea water objects A qualitative biogeochemical cycle; Seawater acidification can damage the ocean. tissue organs for acidity-sensitive species, affects its normal physiological generation Chaix-et growth, ultimately affect the survival of certain organisms in the region @, even cause some biological death, and to Change marine life knot construct, affect ocean food chain, A balance that ultimately destroys the marine ecosystem and stable.

2.2 effects of jellyfish WANFA on marine communities

Jellyfish Wanfa directly or indirectly to other marine organisms. effects, not only affect the number and distribution of marine animals, also on the ocean The primary production of the also has important implications. A large number of jellyfish aggregates occupy other living space for marine life. zooplankton and small fish are
jellyfish Wanfa Nutrition base, and interacting with fishes, is fish young predators for worms and eggs, is also preying on zooplankton and Fishes young A potential competitor to a marine animal that feeds on insects. through the zooplankton and fish effects, Indirect effects on phytoplankton, ultimately affect other fish class Survival, Change the aggregation distribution of plankton, Destroy Plankton Community structure for. The reduction of zooplankton alleviates the of Phytoplankton predation pressure, cause increase in phytoplankton, may raise other secondary Marine Ecological disaster (red tides, Harmful algal blooms such as green tides). jellyfish-flourishing After a large number of decomposed decomposition, provide nutrients for planktonic bacteria, affect float metabolism and community composition of microorganisms.

jellyfish belong to carnivorous animals, Hunt wide, zooplankton, fish larvae and eggs can serve as jellyfish's food, zooplankton is main food for jellyfish. jellyfish nutrition levels in zooplankton and advanced between predatory fishes, and large jellyfish are more likely to consume floating objects. at the same time, jellyfish and fish that feed on zooplankton such as sardines, Herring, anchovy etc Competitive Foods 642-44. The jellyfish Wanfa can be used on these marine Animals Negative Effects, ultimately lead to planktonic nutrition pathway Break and fishery resources 669. In turn, The sea that feeds on jellyfish foreign animals such as rhombus turtle Salmon, The "a"-A-, mackerel, White spot shark etc. Get sufficient food source due to jellyfish Wanfa, Increase the aggregation and biomass of these organisms; death jellyfish moreSome benthic scavengers, food sources for invertebrates, can also be straight To be mineralized by planktonic bacteria into the microbial cycle; death jellyfish Transport has an important relationship with microbial community composition 654-65, jellyfish rot, Solution Nutrients can supply microbial energy, especially dissolved organic material, is the main dissolved organic carbon source of planktonic bacteria.

3. Summary and discussion

jellyfish Wanfa causes are very complex, both with its own physiological structure about life history, also affected by various environmental factors. More Human activity affect. These factors together affect the amount of jellyfish changes and the distribute, so no single reason to explain jellyfish Wanfa, various shadows noise factor interaction function. The Wanfa of the jellyfish depends first on their lives history, sexual asexual Shidai, enables jellyfish to quickly in a short time propagate; Second, jellyfish body structure simple, grows quickly, Predator Range wide, thrive even in bad environments, visible Jellyfish's life Wanfa Reproductive characteristics are the basis of jellyfish. But this jellyfish Wanfa is a_ natural Fluctuations, is a cyclical marine ecological cycle. and in recent years water mother Wanfa Frequent occurrences, indicates that jellyfish Wanfa has become a_ species strict Heavy Marine Ecological issues, has other conditions to induce. causes Jellyfish to Wanfa near The main inducement for the annual occurrence is the change of the marine environment, and its the Most significant change in the, is seawater temperature. Research shows that, for jellyfish Wanfa The most direct inducing factor for seawater temperature changes. jellyfish in many areas Wanfa with seawater warming, like West East China Sea, Northeast Atlantic, [ ] Ben and Europe Coast, besides jellyfish, there are more warm and warm species. ., liking temperature outside warm temperature, Increase water layer at the same level, cause jellyfish Food things increase, can also promote jellyfish reproduction, such as spawning amount, Cross-cleft reproduction and disc larva output, Easy to cause a large number of jellyfish aggregation or even WANFA. its His marine environment parameters such as lighting, salinity, Change dissolved oxygen, etc. Have a certain effect on the jellyfish Wanfa.. But because it's in the ocean Less varied in environment, insufficient to directly cause jellyfish WANFA occur. The intensification of human activities in marine ecosystems is the marine environment main reason for changes, It is also an important inducement factor for jellyfish Wanfa. in Human factors, alien species invasion is jellyfish Wanfa straight connect to trigger, has short time, happening quickly, serious harm etc point, Water eutrophication, climate change, Transition fishing and habitat The changes, and so on, have facilitated the occurrence of jellyfish Wanfa in the order of one, And is a
long-term process.

The impact of jellyfish on the marine environment is mainly reflected in jellyfish to the ocean. The role of the student element, can significantly affect marine ecosystems C, N, P, Loop. jellyfish as a large nutrient pump, to trap the water matrix food-ingested nutrients released to the water release, make C, N, P Heavy live, Change the distribution and content of source elements in seawater; same as when, jellyfish extinction contains C, N, P debris. Sinks to the bottom of the ocean. - The section is directly enriched into sediments, a Partially microbial minerals To Enter the body of water. Jellyfish Reborn inorganic matter for phytoplankton. The Primary production of provides an important source of nutrients, dissolved organic matter absorbed by microorganisms such as phytoplankton to return to Biosphere, Granular the substance sinks into the sediments to supplement the seafloor nutrients. Visible jellyfish-mong Send source elements not only in seawater and sediments C, N, P loop plays an important role, and affect other oceans through the food chain Biology's absorption of the source elements, to the bio-element of The source of the source Chemical Cycling is important. also, jellyfish Wanfa when they die, low / anaerobic environment and seawater acidification. In addition to changing the marine ecology ambient, also affects growth of other marine life, live, propagate, from Change Marine composition, affect the structure of marine ecosystems and stable. jellyfish as, class multiple, quantity is large, a wide range of planktonic species, It can be done with other marine organisms through the food chain with, also indirectly affects other marine life through changes to the marine environment survival and Development; jellyfish Wanfa can cause certain fishes to swim with a floating biomass reduction and redistribution, Serious people can destroy the ecological balance; can cause planktonic microorganisms to increase, Change the composition of microbial communities and Biomass; can also indirectly cause an increase in phytoplankton, affects the beginning of the ocean level production, triggering secondary ecological disaster.

Future research on the ecological and environmental effects of jellyfish WANFA should focus on line: simulation of life history and life cycle of jellyfish and jellyfish population In-time monitoring of changes in quantity and distribution; jellyfish Wanfa in marine ecology The operating mechanism in the system The material conversion of jellyfish WANFA and its release The form transformation of the stocking points; Possible secondary disasters caused by jellyfish Wanfa and ecological consequences; The running mechanism of jellyfish extinction and its coupling to the environment effect: method of suppressing jellyfish mass increase and jellyfish Wanfa after the corresponding measures; to improve the jellyfish-flourishing the recognition, Comprehensive understanding of the mechanism and process of jellyfish Wanfa, “” Prevention and treatment of jellyfish WANFA, to protect the ocean's Biodiversity, provide a basis for maintaining the stability of marine ecosystems.

References

8. Graham WM, Purcell JE. Introduction/Purcell JE, Graham WM, Dumont HJ, eds. Jellyfish Blooms: ecological and societal importance. Amsterdam, the netherlands Springer, 20011 6-13
12. Parsons TR, Lalli CM. Jellyfish population explosions: revisiting a hypothesis of possible causality. La Mer, 2002, 111-121
15. Sun M (Sun Ming), Dongqi (Dong Ji), fuz-l (log Lucy), et al. The effects of light intensity on survival and growth to scyphistomae in jellyfish, Aurelia sp.
17. Ishii H, Shioi H. The effects of environmental light condition on strobilation in Aurelia aurita b20> polyps. sessile organisms, 2003, 201 51-54
29. Ma X, Purcell J. Temperature, salinity, and prey effects on polyp versus Medusa Bud production By the invasive hydrozoan moerisia lyonsi. Marine Biology, 147:225-234