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## Study on the drift caused by ship leaving out of control with dragging anchor in Zhejiang Coastal

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# Study on the drift caused by ship leaving out of control with dragging anchor in Zhejiang Coastal

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**Abstract:** The ship anchored in bad weather, and when dragging anchor, emergency manipulation is the key to ensure the safety of the ship's runaway drift. This paper analyses the preventive measures of ship out of control from several aspects, such as the reason of dragging anchor, the accident of dragging anchor and the emergency plan after dragging anchor.

## 1. Introduction

Zhejiang Coast, with its back to the Yangtze River, is located at the intersection of China's north-south route and the Yangtze River route, has a unique geographical location, and with the implementation of "strong water transport province" strategy in Zhejiang Province in recent years, the coastal area of Zhejiang has been rapid development; with the economic leap, port business are produced by more and more ships, Ningbo-Zhoushan Port is more than the throughput of Shanghai port, crowned the first throne in China. But along the Zhejiang coast, located on the northwest coast of the North Pacific Ocean, often affected by tropical cyclones, cold and high pressure, which bring wind, waves, streams, then uncertain and uncontrollable factors for our ships are brought. As a result of the economic development and the increase in cargo flow, there will be a large number of ships in and out of the port waters every day, quarantine is carried out in the arrival of the port, and waiting berths, waiting tide, anchorage over-barge unloading or outside the port Anchorage anchor. In the harsh weather conditions, due to strong winds, rapids, ship steering and poor bottom quality of anchorage bottom and other reasons, dragging anchor is occurred easily. The ship out of control and the drift caused by dragging anchor and there is no good emergency plan for dense ship, collisions is happened between ships extremely easily, In this paper, the emergency plan of ship drift caused by dragging anchor and the technology of preventing dragging anchor producing drift will be reported.

## 2. Reasons and analysis of dragging anchor

Ship dragging anchor referred to the inadequate anchoring force, when the sum of the wind flow and other external forces are greater than grip produced by the anchor and anchor chain, the anchor would move on the seabed, then the anchor would not have a fixed position on the ship, the location of the ship also began to move due to the influence of wind and wave flow, the ship out of the anchorage state began to move, which is called dragging anchor.

Zhejiang coastal Climate: The coastal area of Zhejiang Province, in the July-September of the year was the season of the typhoon, the gale and rainstorm weather were brought by the tropical cyclone,



which brought huge safety risks to the coastal anchorage of the ship; However, in September-December would be affected by cold air from the north, cold air Regiment and warm air Regiment meeting to form strong , causing strong winds; whether it was the impact of the typhoon in summer and autumn or due to the impact of cold and high pressure, would bring intense wind and waves, surges, streams, etc. In bad weather when the wind and flow on the ship's role was inconsistent, a bias phenomenon would be produced, then a heavy bias phenomenon would be taken place, and the impact of the change of the anchor chain was easy to loosen the anchor claw at the bottom of the sea, causing the anchor to move or even flipping the anchor, when the wind, flow, waves reached to a certain extent; In the ship's numerous coastal Zhejiang coast, collision was emerged by the ship's runaway anchor, resulting in huge economic losses.

**Zhejiang Coastal Bottom quality:** Zhejiang coastal area because of the back of the Yangtze River estuary, the sea water was yellow, the bottom of the submarine was mostly sediment for the coastal ship Anchorage provides a good innate conditions, but there were still areas of gravel, as well as bad uneven terrain. Submarine bottom quality determined the size of Anchorage grip, of which the clay was the best, sediment area could also be anchored, the worst was gravel, shells and other areas, which was easy to lead to anchor, causing the ship in a dangerous situation, resulting in immeasurable direct economic losses.

**Tide:** Zhejiang Offshore was one of the strong tidal areas in China, and its tidal difference was generally larger. According to the analysis of tidal difference table comprehensive statistics found that the largest distribution of tidal difference was located in Hangzhouwan, followed by Leqing Bay and Sanmen Bay, Zhoushan Qundao part of the region tidal difference the smallest, Leqing Bay, Sanmen Bay and other tidal difference were about 4 meters, Hangzhouwan tidal difference were about 5 meters. The flow rate of slack water was relatively small, the anchor in a lax state would not be grasped at that time, with the beginning of the turn of tide, the flow rate of the seafloor accelerated, resulting in the ship with the flow of water, then the anchor was in lax state having not been taut, which produced the great probability of the ship dragging anchor and out of control drift.

**Crew operation:** In recent years, due to the rapid development of shipping enterprises, the relaxation of the training of crew members, resulting in some crew members in the event of an emergency, can not cope with the unknown from where to start, emergency response capacity was insufficient, resulting in missed time, causing disaster. Of course, when the ship was moored and anchored, due to improper operation, such as insufficient back speed, or loose chain too fast, or too short out of the chain and so on, so that the anchor claw could not be very good into the bottom, so that the anchor could not firmly grasp the bottom, which were easy to cause the phenomenon of dragging anchor.

### **3. Emergency plan after anchor accident and ship dragging anchor**

August 7, 2012, strong typhoon "anemone" gradually approaching the north-central coast of Zhejiang. In the typhoon raging, the six transverse sea northeastern wind reached ten-twelve level, huge waves, torrential rain, moored in the southern waters of Putuo Shrimp Zhi Island, "Anhui Taihu cargo 9009" wheel occurred dragging anchor, about at 18:48, "Zhouzhou mop 19" wheel to the scene of distress, the implementation of rescue, and at 18:55 successfully rescued three trapped in the ship's three crew members, fortunately, casualties and greater property damage were not produced.

May 31, 2012 0110, Shanghai Rui Yuan Shipping Co., Ltd. belonged to the "Dragon Ocean 27" wheel. On the way from Taizhou jinqing to Shipu, anchorage outside the port of Shipu port (approximate 29° 08'7N/121° 58'3 E) during Anchorage, the ship was suspended for three days due to a stranding accident on the ship's dragging anchor.

All two incidents were due to the impact of the gale, resulting in ship dragging anchor accidents, the safety of human life were put in danger, there were also significant factors that were human vigilance negligence, the captain during the ship Anchorage, who did no real-time survey of the special geographical environment and meteorological changes of the anchorage, the alert in bad weather was negligent, In the approaching of wind and waves, emergency measures were not taken, such as increasing the length of the chain, standby engine during the anchorage period, and strengthening the

duty for the additional staff. In bad weather, when the ship had dragging anchor phenomenon, and at this time the ship was out of control drift, could not use the rudder to stabilize the hull, at this time the best way was to drag anchor, but breaking down should not be immediately thrown to death, if such operation, larger deflection, more anchorage damage and the risk of breaking the anchor would be produced.

In the coastal area of Zhejiang Province, when the bottom quality was good, the wind level 6-7 was anchored more than 5 knots, wind speed to 8-10 level should be broken down more than 6 knots, when in case of typhoon, breaking down should reach at more than 9 knots to achieve effect of the anchor, the specific anchor length could be selected according to the following formula suitable length (Bad situation:  $4d+150m$ ,  $d$  is water depth of the anchorage, if the bad weather at that time should be appropriate to increase the length of the chain).

When meeting typhoon, riding at single anchor had been unable to achieve the effect, it was necessary to increase the length of the chain, at this time the bow would swing upward direction, needing to the wind direction full rudder, when the bow toward the wind direction, throw down the leeward anchor, flying moor would be formed to obtain the maximum anchor grip, while the ship engine increased the output power, ensure that the anchor chain and anchor gear were not destroyed in the gale during the stagnation.

#### **4. Emergency plan after dragging anchor**

When man on board found or suspected dragging anchor, who should report it to the captain in time to make a decision.

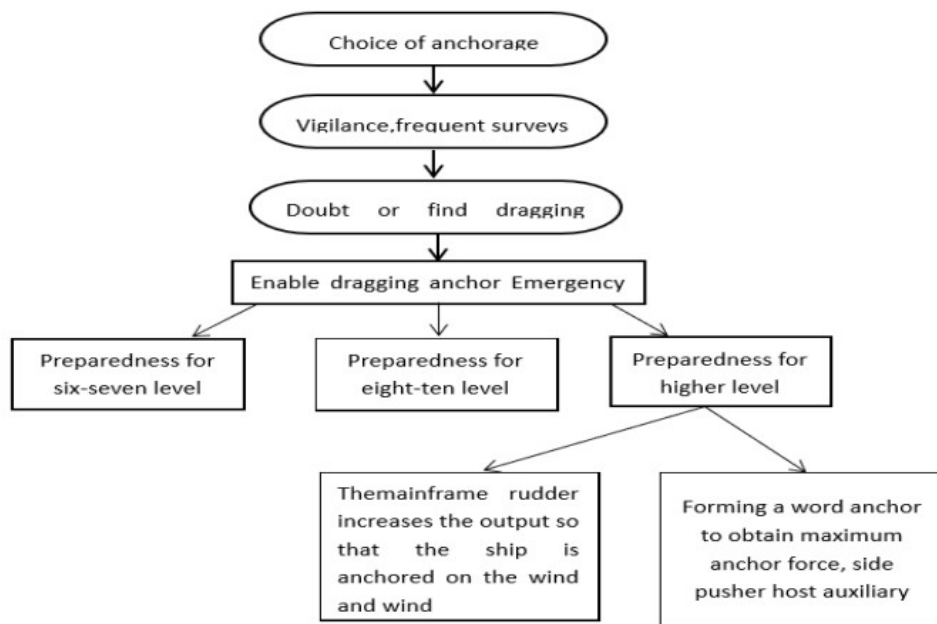
The driver on duty should urgently inform the cabin standby engine, with the help of the bow swing drift to adjust the bow wind, the use of the host to increase the output power, reduced the force of the anchor chain, effectively reduced the ship deflection, stabilized the ship, (when the wind speed was about 20m/s, the application of rudder slow ahead; When the wind speed was around 25m/s, application of rudder order half ahead; When the wind speed was 30m/s, the use of rudder order full ahead) used a side pusher, when the ship was dragging anchor and was being pressed to the leeward side, the use of a side pusher could make the ship gradually stand up to the wind, when the situation was bad, added a second anchor to form flying moor, got the maximum drag force.

Use VHF to report proximity to maritime agencies for emergency assistance, or use other means of communication to report in a timely manner, so that nearby ships were aware of the critical situation, seek help, and change the ship's AIS dynamics, from the anchorage state to a runaway state, hanging or fired a "Y" signal, signaling the surrounding ship safety, and appropriate countermeasures should be taken to avoid danger.

The most appropriate measures were taken in the light of the prevailing environmental situation.

Prevention and treatment of dragging anchor drift solutions and technical routes

First of all, when deciding to anchorage, you should choose a good anchorage for avoid typhoon, suitable the bottom quality of anchorage could not be gravel baker bottom, because of the coastal areas of Zhejiang existing dense ships, in the premise of ensuring suitable for water depth and sufficient anchorage waters, should choose those already in the anchorage of the leeward side of the ship, if the choice in other anchorage of upper wind side, which was easy to cause tension because of a small operation of improper, however, in the leeward side even if dragging anchor had been taken, which could also avoid other ships or offshore facilities, in the absence of suitable leeward side anchorage, could only choose the upper side of the open water, to their own leave enough operation of emergency space; When the ship was in bad weather, The driver on duty should pay close attention to the anchorage of the ship, observe the ship's deflection, can use the radar and GPS track display to monitor the anchorage situation, when found or suspected dragging anchor, should immediately report to the master, the ship personnel to wind speed, wind direction, wave height, surge cycle, flow direction and rate, etc. and contact the type of their own ships, draught and longitudinal tilt and so on to evaluate. After determining the dragging anchor, the emergency plan of the anchor was enabled (Figure 1).



**Figure 1.** Emergency plan after dragging anchor

## 5. Conclusion

With China gradually moving towards a shipping powerhouse, Zhejiang Province as a more economically developed coastal area, first carried out the "water transport strong province" strategy, attracted a large number of ships in Hong Kong business, because of the increasing number of ships, the importance of safe anchorage is self-evident. the study of the anchor in the coastal areas of Zhejiang led to the uncontrolled drift of ships, according to the background characteristics of Zhejiang province, climatic conditions, etc., so as to make an effective and effective post-anchor emergency plan and measures to prevent dragging anchor.

## References

- [1] Hong Biguang. Ship manipulation Dalian. Dalian Maritime University Press, 2008.5
- [2] China Maritime Service Center Organization. Nautical meteorology and oceanography. Dalian Maritime University Press 2012.5
- [3] Wu Youhong. Analysis of the reasons for the anchor and countermeasures. The Proceedings of the 4th Guangdong Maritime Advanced Forum
- [4] Xu Jiaqing. Methods to deal with ship's anchor-nautical techniques, issue 4, 2014
- [5] Liu Fanggui Honggang, Analysis of ship Anchorage and its Detection methods, Journal of Dalian Marine Institute, 1993.5