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Research Article

The Relationship Between Climate Patterns, El Nino And La Nina With People's Salt Production In Jepara Regency, Central Java Province, Indonesia In 2015-2023

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ABSTRACT
Indonesia is considered an archipelagic country with the longest coastline in the world, assuming there is a large salt production area along its coast, but the level of salt production produced is not yet able to meet domestic salt needs, so some of the salt needs are imported from other countries. The purpose of the study is to examine the relationship between the productivity level of people's salt in Jepara Regency and Demak Regency in relation to El Nino and La Nina events throughout 2015-2023. The method used is to analyze El Nino and La Nina events with annual salt production data produced in Jepara Regency. The results showed that there was a correlation between the two, namely high salt production levels related to dry El Nino years, and low salt production levels related to wet La Nina years.

Keywords: salt, climate patterns, jepara regency

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INTRODUCTION

Indonesia as an archipelagic country with a coastline length of 95,181 km in terms of salt production is still considered inadequate. For comparison, as the world's number one salt-producing country, China with a coastline of 30,017 km, which is one-third of Indonesia, is able to produce as much as 70 million metric tons of salt. India with a coastline of 7,517 km is able to produce 16 million metric tons, while Indonesia is only able to produce 300 metric tons (KKP, 2017).

The need for salt consumption nationally for all sectors is always increasing year by year, but the level of production produced in various salt production areas has not been able to meet these needs. One way out to overcome this is to import salt from other countries. National needs increase by an average of 2-4 percent per year. For example, the national production of salt in 2017 was 1.3 million tons while the national demand was 3.9 million tons (KKP, 2017).

Nationally, based on data from 2011-2016, the highest productivity occurred in 2015 and the lowest in 2016. Several salt-producing districts are able to continuously produce salt above 100 tons per year, including Jepara, Cirebon, Brebes, Demak, Pati, Rembang, Lamongan, Surabaya, Sampang, Sumenep, and Bima (KKP, 2017).

According to Juna & Surur (2018) many obstacles to people's salt are still difficult to develop in Indonesia. First, Indonesia has a fairly high humidity (air humidity) in the range of 60-70. Meanwhile, in Australia the air humidity is around 20-30%. Second, Indonesia experiences a relatively short dry season, which ranges from 4 to 5 months per year. Although in eastern Indonesia the dry season can reach 7 to 8 months per year, in these regions salt productivity has not been optimally worked out. Third, the ownership of salt pond land is too small. The average is only 0.5 to 5 hectares per pond, with the arrangement of refining plots and crystallization plots that do not meet the requirements. In addition, the production pattern of local salt farmers is still traditional.

RESEARCH OBJECTIVES

The purpose of the study is to examine the relationship between the productivity level of people's salt in Jepara Regency and Demak Regency related to El Nino and La Nina events throughout 2015-2023

RESEARCH LOCATION

Jepara Regency, Central Java Province, Indonesia. Coordinates
geography between 6° 38'44,29" – 6° 42'27,42" South, and110° 37'24.48" – 110° 38' 51.01" East.

RESEARCH METHODOLOGY

The research material includes salt production data from authorized agencies in Jepara Regency in 2019 and 2023. Meanwhile, climate data was obtained from the Central Java Province PUSDATARU website. The climate data used are rainfall and evaporation.
Climate station data:

1. Station : Pladen, Kaliwungu, Kudus
2. Coordinates : 06°47'57.28" south latitude, 110°56'11.56" east longitude
3. Station location : Garung, Kali Wulan watershed
4. Altitude : + 12.51 m above sea level
5. Owner : PUSDATARU Central Java Province

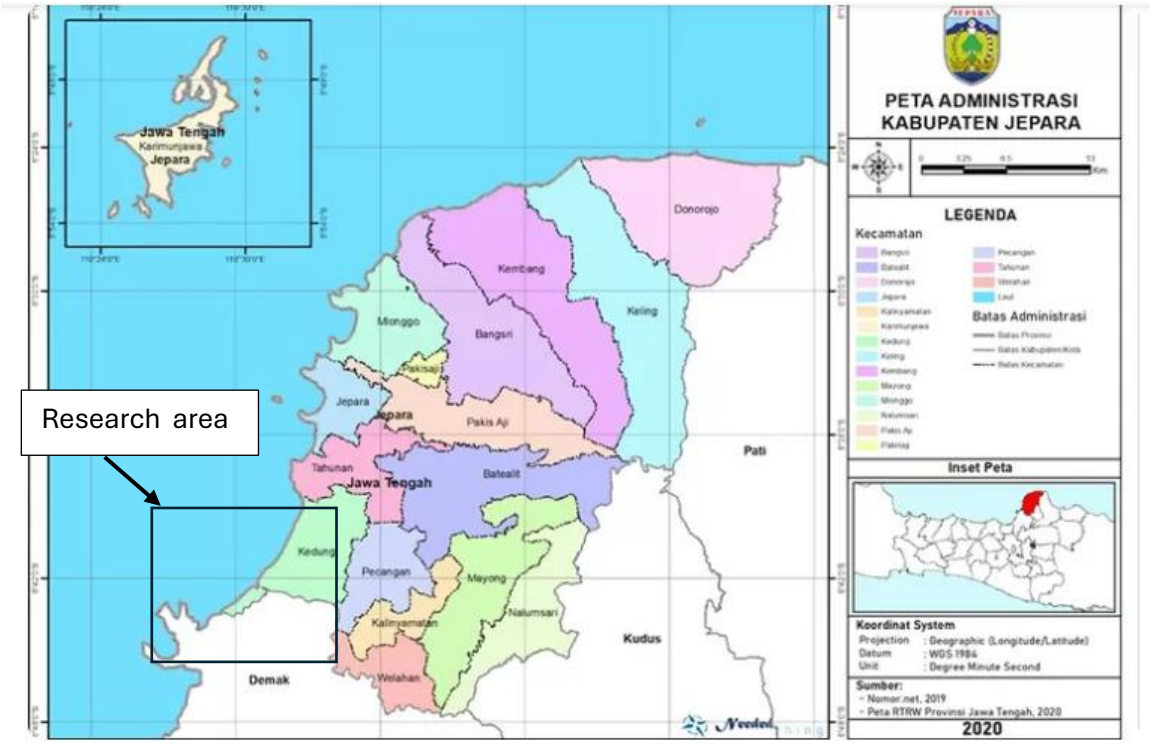

Figure 1. The map of administration of Jepara Regency, Central Java Province, Indonesia

RESULTS AND DISCUSSION

a. Geographical overview of Jepara Regency, Central Java Province

Jepara Regency is one of 34 districts in Central Java Province (Figure 1). Jepara Regency is also one of the districts in Central Java Province that has salt production in addition to Demak, Pati, Rembang, and Brebes. The geographical condition of the Jepara Regency area with the relatively flat condition of the western coast in the form of coastal alluvial plains is very suitable for development as salt pond land. Climatic conditions support the development of salt production (discussed separately in the next subchapter). The relatively small river network and the availability of a tidal river network that grows naturally in the salt pond location are natural supporting factors for the development of the salt pond business.

From the regulatory aspect of the Jepara Regency Government through the Jepara Regency Regional Regulation No. 2 of 2011 concerning the Spatial and Regional Plan 2011-2031, it states based on Articles 22 and 31 if the area on the west coast which includes Kedung District is developed as a fishery or industrial cultivation area.

b. Climatic conditions

The climate data displayed are those that are related to salt production are rainfall and amount months without rain. The data was taken from Pladen Station, including the Kudus area as the closest meteorological station to the research location. Rainfall with values above 100 mm occurs in January, February, March, and November. Meanwhile, rainfall with values below 100 mm occurs in the months of April, May, June, July, August, September, and October. In August and September there is no rain. Meanwhile, evaporation values with accumulated values above 100 mm occur in the months of May, June, July, August, September, and October. Among the parameters of rain and evaporation that have the most influence on salt production is rain.

c. Kedung District as a salt producer

Kedung District has an area of 45.71 km² consisting of 18 villages, including 6 villages directly adjacent to the sea, with a population of 82,574 people in 2023, so it has a density of 1,807 people/km² (BPS Jepara Regency, 2024). Table 1 shows data on area area, population, and density in 6 coastal villages in Kedung District. Among the six villages, the most extensive area is Kedungmalang, but the highest population density is found in Bulakbaru village with the smallest area, which is 1321 people/km². Among the total population of the 6 villages who work as fishermen is 1,726 people (Jepara Regency Communication and Information Office, 2021).

Table 2 shows the salt production of Jepara Regency during the 2015-2023 period. Since 2015, salt production has fluctuated with the largest production occurring in 2019, which was 66,736 tons. The following year, salt production decreased and increased again in 2023, reaching 56,564 tons. Production in 2023 has moved up from previous years, although not as high as in 2019. Table 3 shows the breakdown of salt production by village unit where based on a comparison of salt production years per village between 2019 and 2023 in all villages is not as much as production in 2019, except for salt production in Kalianyar village which is larger than in 2019. Even then, it only increased by 234 tons or less than 1000 tons.

Table 1. Area, population, and density in salt-producing coastal villages in Kedung District, Jepara Regency

Village	Area (km^2)	Population (population)	Density (population/km^2)
Kedungmalang	5.18	5,115	987
Kalianyar	2.08	537	258
Surodadi	4.88	3,992	818
Panggung	1.93	2,099	1,088
Bulakbaru	0.70	925	1,321
Tanggultlare	1.71	708	414
Total	16.48	13,376	811

Sources: secondary data processing; BPS Jepara Regency (2024)

Table 2. Salt production in Jepara Regency from 2019-2023

No	Year	of Production (ton)
1	2015	55,000
2	2016	28,806
3	2017	16,705
4	2018	49,302
5	2019	66,736
6	2020	33,068
7	2021	22,789
8	2022	12,885
9	2023	56,564

Source: Jepara Regency Fisheries Office

Table 3. Salt production per village in Kedung District, Jepara Regency in 2019 and 2023

No	Village	Salt land area (ha)	in 2019 (ton)	in 2023 (ton)
1.	Kedungmalang	154	20,410	14, 907
2.	Kalianyar	54	7,266	7,520
3.	Surodadi	109	15,071	14,454
4.	Panggung	100	14,498	12,153
5.	Bulakbaru	45	6,397	4,530
6.	Tanggulttlare	23	3,094	2,990
	Total	485	66,736	56,554

Source: Jepara Regency Fisheries Office (2023)

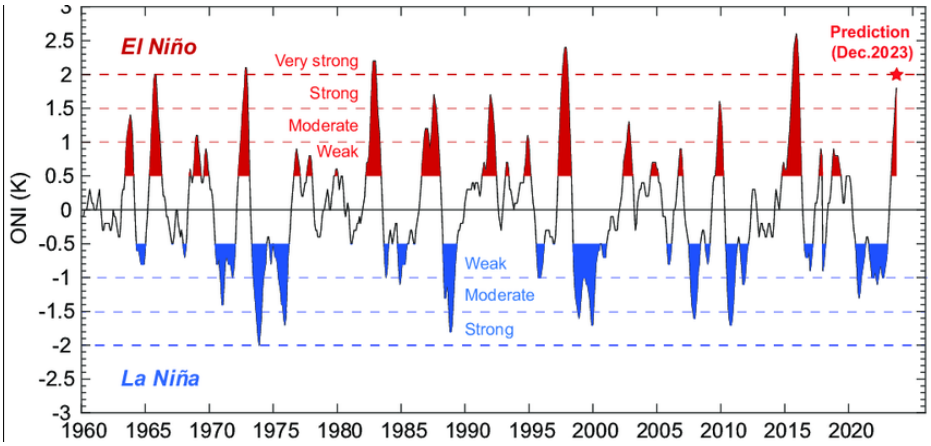

Figure 2. Graphic of El Nino and La Nina conditions from 1960-2023

Table 4. People's salt production in Jepara Regency and its relationship with El Nino and La Nina events from 2015-2023

No	Year	of Production (tons)	Year of El Nino and La Nina	sum of rainfall (in mm)	months without rain
1	2015	55,000	El Nino- very strong, dry	1,400	4
2	2016	28,806	La Nina – weak	1,993	1
3	2017	16,705	La Nina – weak	1,449	0
4	2018	49,302	El Nino – weak	1,889	1
5	2019	66,736	El Nino – weak	2,070	4
6	2020	33,068.05	La Nina- weak	3,484	0
7	2021	22,789.05	La Nina- weak	2,535	1
8	2022	12,885.4	Normal	2,307	0
9	2023	56,564.0	El Nino-strong	1,792	4

Source: Jepara Regency Fisheries Office (2015-2023), Central Java Province PUSDATARU (2015-2023)

Salt production in relation to climate

Jepara Regency has salt production reaching its highest production point in 2019, which is 66,736 tons per year and fluctuates from year to year. Salt production is produced through the traditional method, namely through the evaporation process by relying on the production period in the dry season. The salt producing area comes from coastal villages in Kedung District (see Table 2 and Table 3) with the highest production produced from Kedungmalang village of 20,410 tons (in 2019) and 14,907 tons (in 2023). During the 4-year interval (2019 – 2023) people's salt production has decreased, both by producing village and in total by sub-district.

Based on the results of interviews with local residents, the salt production period generally starts from May and ends in November every year. The peak of salt production occurs in August and September. Data on

recording salt production per month for each salt-producing village is not available.

If salt production is associated with climatic conditions, it shows that salt production in salt-producing locations takes place during the dry season, namely from April/May as the preparation stage to November as the beginning of the rainy season. Among the most influential climatic factors is rainfall, which is in the dry season period at production sites of less than 100 mm per month. A value of less than 100 mm in rainfall is used by BMKG as a benchmark for the dry season. Rainfall conditions are the main indicator of the start of salt production, namely by reducing the amount of rainfall. According to the KKP (2017), the salt production process for areas such as the north coast of Java and Nusa Tenggara begins in May/June as the beginning of the dry season.

Research conducted by Juna & Surur (2018) in Bangkala District, Jeneponto Regency, South Sulawesi as a salt farming location recorded salt productivity with climatic conditions. The climatic condition of Jeneponto Regency is identical to the climatic conditions of other regions on the island of Sulawesi as a whole, this can be seen at a maximum air temperature of 35°C and a minimum air temperature of 26°C with the lowest rainfall of 1,049 mm/year and the highest of 3,973 mm/year.

In the process of making traditional salt, there are stages, one of which is the drying stage. In the drying stage, it requires the scorching sun to dry and dry, so in this case the long time of irradiation is important for the process to take place (Maflahah & Asfar, 2018). Meanwhile, according to Nadjib YN (2007) based on a study of salt productivity in several places in Java and Madura, the parameters that have a big influence on salt productivity are climatic factors, including: the length of the dry month, temperature, and humidity.

Research by Alfiqri, et al. (2024) and Yananto & Dewi (2016) that between 2015-2016 are El Nino years and the 2020-2021 period is La Nina years. According to BMKG (2023) in 2022-2023, La Nina conditions are weak and the index is in a neutral or normal position. The years of El Nino and La Nina occurrences from 1960-2023 are seen in Figure 2. El Nino can be interpreted as a drought year, while La Nina can be interpreted as a wet year. Based on climate data, the 2015-2016 period shows an El Nino phase, which is where the intensity of rain decreases, while the 2020-2021 period is a la nina period, which is where the intensity of rain increases. According to Yuniasih, et al. (2022) since 2015-2022 the El Nino and La Nina years are: 2015 (weak-very strong El Nino), 2016-2018 (normal), 2019 (weak El Nino), 2020 (normal), 2021-2022 (weak-moderate La Nina).

There is a relationship between El Nino and La Nina years to salt production in an area. Salt production figures increase correlated with dry years. The year 2015-2016 was declared an El Nino year with an index value greater than 2.5, which means it was the peak of drought. Salt production in 2015 in Jepara Regency reached 55,000 tons, then in 2016 and 2017 salt production decreased. Salt production increased again for the 2018-2019 period with a peak in 2019 with a production figure of 66,736 tons. The period of 2020-2021/2022 as an El Nino year salt production decreased, and in 2023 production increased again as El Nino years strengthened.

Salt production cannot be linked to the value of its production only with indicators of El Nino or La Nina events, but it is necessary to look for its relationship with the climatic conditions that prevail for those years, especially its relationship with rainfall conditions and months without rain. Table 4 data is shown on the total annual rainfall where salt production in 2015 is indeed related to the dry year (El Nino) with an annual rainfall of 1400 mm which is the smallest amount between the 2015-2023 period. The condition of 2019 is the year with the largest salt production, which is 66,736 tons. 2019 was an El Nino year with a weak index, but with a total rainfall value of 2070 mm which was higher than the previous four years. How to explain the problem of 2019? If you look at it in more detail based on data on rainy days, it turns out that for 2019 there are no rainy days 4, namely in the June-September period.

Production in 2015 was 55,000 tons and in 2023 of 56,564.0 tons turned out to have a similar pattern of climate conditions to 2019. The condition in 2015 is that in the June-September period there is no rain, except in August there is 1 rain. In 2023 for the June-October period there will be no rain, except in July alone by 32 mm.

CONCLUSION

Salt productivity in Jepara Regency fluctuates in relation to the El Nino and La Nina years. High productivity occurs in El Nino years (dry years). On the other hand, in La Nina years (wet years) the productivity rate is lower. Still related to dry years, annual climatic conditions with the number of months without rain turned out to play a role in the high productivity of salt.

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