

significant addition to the reclamation area occurred in Bojonegara Village covering an area of 83.35 ha which is wholly allocated for industrial activities. In 2010 the area of Bojonegara District was 3,017.09 ha, with two villages located in the coastal area, namely Bojonegara Village of 336.51 ha and Margagiri Village of 349.37 ha.

Settlements, agriculture, plantations, and industrial activities on the coast dominated land use in Bojonegara District in 2010. Then there was a change in the area of land in Bojonegara District, namely the expansion of land by 3.5%, 111.7 ha from the previous area. The most significant amount of land expansion is in Bojonegara Village, with a percentage of 21.1%, which is 90.5 ha from the previous area. Referring to the Regional Spatial Planning directive, the designation for industrial activities is set at 1,491.11 ha, for the protected forest at 562.08 ha, and the rest is allocated as urban areas, namely settlements and other supporting facilities. Therefore, the reclamation area built is not following the spatial planning of the coastal area.

Based on the distribution of industrial activity locations in the Bojonegara District, the coastal areas have the highest industrial activity compared to mainland areas. The high intensity of industrial activities in this coastal area causes limited land for developing industrial activities, thus triggering these industrial activities to carry out reclamation activities to meet the adequate space necessity.

TABLE V
LAND USE IN BOJONEGARA VILLAGE (HA)

Type of Land Use	2005	2010	2015	2020
Reclamation Industry	35.80	128.60	187.08	260.40
Non-Reclamation Industry	10.20	52.70	58.60	97.54

Coastal areas have high complexity. As a single coastal ecosystem, changes in the regional landscape and increasingly massive anthropogenic activities have an impact on seagrass ecosystems. Seagrasses can live optimally in waters with surface temperature conditions between 25oC-30oC, salinity between 24o/oo to 35o/oo, and TSS below 20 mg/l (38). Based on the results of laboratory measurements, it is concluded that two stations located around Lima Island, a habitat for seagrass ecosystems and one of the fishing locations, experienced an increase in TSS or sedimentation. Meanwhile, the heavy metals suspected of contaminating these waters were not found in the sample through measurements and laboratory tests. This research findings follow [3], [4], [36], [37], where water conditions in Bojonegara can still be seen as tolerable but not in line with the findings from prior research conducted [16], [17].

This increase in sedimentation is supposed to be due to port construction activities for industrial activities. Port activities, in addition to potentially causing sedimentation, also have the potential to pollute water areas, especially seagrass. It is known that in two locations around Lima Island, the water quality has exceeded the conditions for seagrass to live. Seagrass is the only flowering plant that can survive and adapt to life in water with high salinity. Seagrass ecosystems on Lima Island provide economic benefits and environmental services for coastal communities in Bojonegara Village. The seagrass ecosystem functions as a nursery ground and spawning ground and provides economic benefits, namely as

a capture fisheries area such as shrimp, grouper, tuna, mullet, and snapper main catches of fishermen. The impact of seagrass on fishermen is that the area around the seagrass ecosystem has an abundance of fish.

Fishermen in Pansoran Village use the seagrass ecosystem area on Lima Island as one of the fishing areas. Most of these coastal communities' work as fishermen and depend on their livelihoods to catch fish and look for shellfish using modern and traditional fishing gears, such as bondet, arad nets, small and large blades, rawe, and gill nets in the seagrass ecosystem area [19]. It is known that the amount of capture fisheries production in Serang Regency in 2011 reached 14% of the total production of Banten Province, which was about 8,061.5 tons and was the three largest contributors to capture fisheries production after Pandeglang Regency and Tangerang Regency. Banten Bay is one of the areas that play a role in the contribution of capture fisheries production to Serang Regency because its area is directly adjacent to the Java Sea. In 2015 the total production of capture fisheries in Serang Regency was 7,879.3 tons. Based on the data in Figure 5, from 2011-2015, it is shown that there were decreases in the number of captured fisheries productions by 182.2 tons.

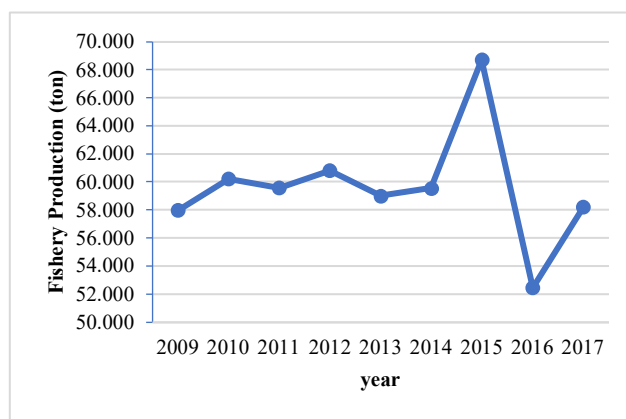


Fig .5 Total Capture of Fishery Production

Fishing is a cultural activity passed down from generation to generation in a coastal community. Along with the increase in TSS in the Banten Bay waters, the seagrass ecosystem in the Bojonegara District waters has decreased, as shown in Figure 3. This change also causes a decrease in economic benefits or utilities for coastal communities in Bojonegara District. This economic valuation calculation will use Formula 1 to calculate the total economic value of the seagrass ecosystem, both direct and indirect benefits. Assessment of direct benefits is calculated by using a fishery production approach.

In contrast, indirect benefits are calculated from the environmental services of seagrass ecosystems as fish spawning grounds and preventing abrasion. The calculation uses a replacement cost approach from constructing fishponds and bamboo sheet piles. Changes in economic benefits and environmental services from the loss of seagrass ecosystems are shown in Table 6.

This economic loss's high value occurred due to the low level of public knowledge and public awareness. It is indicated from the interviews with fishermen respondents that only 19% of fishermen recognize the types of ecosystem variations in coastal areas, their existence, current conditions,

and utilization. Another 81% only know one of the three ecosystems and their locations but have never utilized and made improvements.

TABLE VI
RESULTS OF CALCULATION OF ECONOMIC VALUATION

No	Seagrass Ecosystem Functions	Analysis Methods	Loss Value due to damage Occurred (Rupiah)
1	Seagrass ecosystems as fishing grounds	Productivity approach	8,527,773
2	Seagrass ecosystems as fish spawning grounds	Replacement Cost	72,000,000
3	Seagrass ecosystem as abrasion prevention	Replacement Cost	870,000,000
Total Loss Value due to Damage			950.527.773

Moreover, it is known that only 27% of the respondents know the types of ecosystems on the coast of Bojonegara Village, and the remaining 73% do not know. The environmental awareness from the industrial sector is still inadequate. The company's CSR activities have provided physical assistance for food, clothing, and other goods and have not touched community capacity-building service. In addition, there are still violations committed by the industry with various cases, even though they have a downward trend from 2015 to 2020 (Figure 6).

The decrease in the case numbers is one of the government's monitoring efforts to prevent environmental damage in the coastal area of Bojonegara Village. Some of the cases often encountered in this location are the environmental permit had not been issued but had carried out activities ahead and the neglect of completion of primary wastewater treatment.

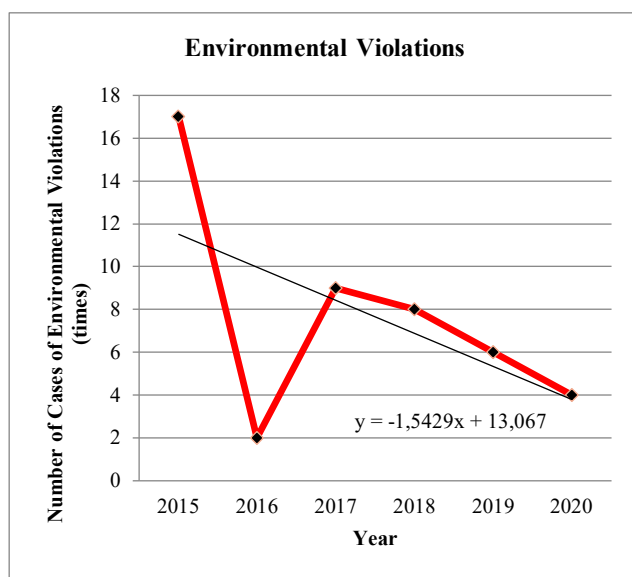


Fig. 6 Number of Cases of Environmental Violations by Industries in Bojonegara Districts

IV. CONCLUSION

From the study results, it can be concluded that it is true that environmental damage is occurring in coastal areas of Bojonegoro District to Lima Island. The value of Natural Resources and Environmental Services Loss can be estimated by analyzing the productivity approach on seagrass and mangrove ecosystems as fishing grounds and replacement cost on seagrass and mangrove ecosystems as fish spawning grounds and abrasion prevention. The total loss value due to damage is estimated at IDR. 950.527.773 per year. This study finds the high economic loss is due to the low level of public knowledge and awareness, as only $\leq 19\%$ of the respondents recognize the types of ecosystem variations in coastal areas, their existence, current conditions, and utilization.

Based on the results of laboratory measurements, it was discovered that two stations located around Lima Island, a habitat for seagrass ecosystems and one of the fishing locations, experienced an increase in TSS or sedimentation. Meanwhile, the heavy metals suspected of contaminating these waters were not found in the sample through measurements and laboratory tests. This increase in sedimentation is supposed to be due to port construction activities for industrial and port activities.

These findings prove the hypothesis that the industry still commits environmental violations, which causes water pollution in various cases. It is concluded that in two locations around Lima Island where the sample was collected, the water quality has exceeded the conditions for seagrass to live. As The seagrass serves its ecosystem function as a nursery ground and spawning ground, in the long run, the disruption of its habitat might cause a decrease in the number of capture fisheries, such as shrimp, grouper, tuna, mullet, and snapper, which are the main catches of fishermen. Therefore, it is crucial for the stakeholders, especially policymakers, to resolve these cases to avoid further environmental damage that may cause higher economic loss. To date, the positive reinforcement of the local government's settlement and monitoring efforts can be observed from the decrease in the environmental violation case numbers to prevent environmental damage in the coastal area of Bojonegara Village, which can considerably improve the future of Banten Bay management.

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