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## **Socio-economic effects of fishing activities on the Bandama river in the Agnéby-Tiassa region (Côte d'Ivoire)**

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### **Abstract**

Fishing is important in the fight against food insecurity, unemployment and in creating jobs. This study describes the socio-economic effects of fishing activities in the Agnéby-Tiassa region. Information was collected through a questionnaire, interview and direct observation in the field. Analysis of the data obtained showed that fishing activities in Agnéby-Tiassa is a source of jobs and earnings. Daily earnings vary between 15000 and 25000 FCFA. The fish marketing is carried out by women, 24% of whom are wholesalers, 18% of whom are smokers. Those who resell the fish represent 76%. The income derived from this activity allows the actors to mainly educate their children (35%). The consumption of fish contributes to the satisfaction of the food needs of the populations and to the improvement of health thanks to the intakes of proteins, iodine and vitamins.

**Keywords:** Fishing activities, Socio-economic effects, Bandama River, Agnéby-Tiassa

### **Introduction**

Fishing is of social and economic interest in the world thanks to its contribution to food security. This interest is also justified by the fact that it is a source of income for the actors and currency for the State <sup>[1]</sup>. Moreover, this activity represents a source of protein for the populations <sup>[2]</sup>. Also, activities directly or indirectly linked to fishing contribute to the fight against youth unemployment and food insecurity.

Indeed, the processing, packaging, marketing and distribution of fishing products; the manufacture of fish processing equipment, the manufacture and repair of fishing equipment, and the production and supply of ice offer many jobs to the population <sup>[3]</sup>. This is why the development of fishing and fish farming has become a priority for many countries in West Africa <sup>[1]</sup>.

According to this organization, fishery products are also sources of protein and help ensure the food and health of populations in the poorest households, as is the case in Côte d'Ivoire <sup>[4]</sup>. This is why this author believes that sustainable management of the fishery resource in Côte d'Ivoire is necessary and this necessarily requires the existence of reliable data on the fishing sector.

The present study is part of a series of works aiming to constitute a database on the fishing activity practiced in the watersheds of rivers, rivers and lakes of Côte d'Ivoire. It was carried out on the Bandama River in the Agnéby-Tiassa region in central Cote d'Ivoire. The aim of this work is to deepen knowledge on the socio-economic effects of fishing activities in this region orphaned by such a study.

### **Material and Methods**

#### **Study area**

This Work was carried out in the Agnéby-Tiassa region on the Bandama river downstream of the Taabo dam lake between 6 ° 00'-6 ° 20 'North latitude and 4 ° 90'-5 ° 00' West longitude (Figure 1). This area is characterized by a substrate made of large rocks, sands and gravel with a heterogeneous population operating in several economic fields. Three Sub-prefectures were selected for the surveys: the sub-prefecture of Taabo, with the stations of N'Dènou, Ahouati and Sokrogbo; the sub-prefecture of Pacobo with the station of Singrobo and the sub-prefecture

of Tiassalé with the stations of Broukro, Tiassalékro and M'Brimbo.

**Data collection and processing**

The choice of these stations depends on their proximity to the Bandama River where fishing is a very important activity; the existence of a commercial fish exploitation, their easy accessibility in all seasons by road and the density of their population.

Data were collected using a questionnaire, interview guide and direct observation in the field. The questionnaire collected information on production, sale, price fluctuations, income, the contribution of fishing to the local economy, the contribution of fish to food and food security.

The interview guide was used during meetings with customary authorities, fisheries managers, health workers and local administrative officials who are the resource persons for qualitative data on fisheries management and products.

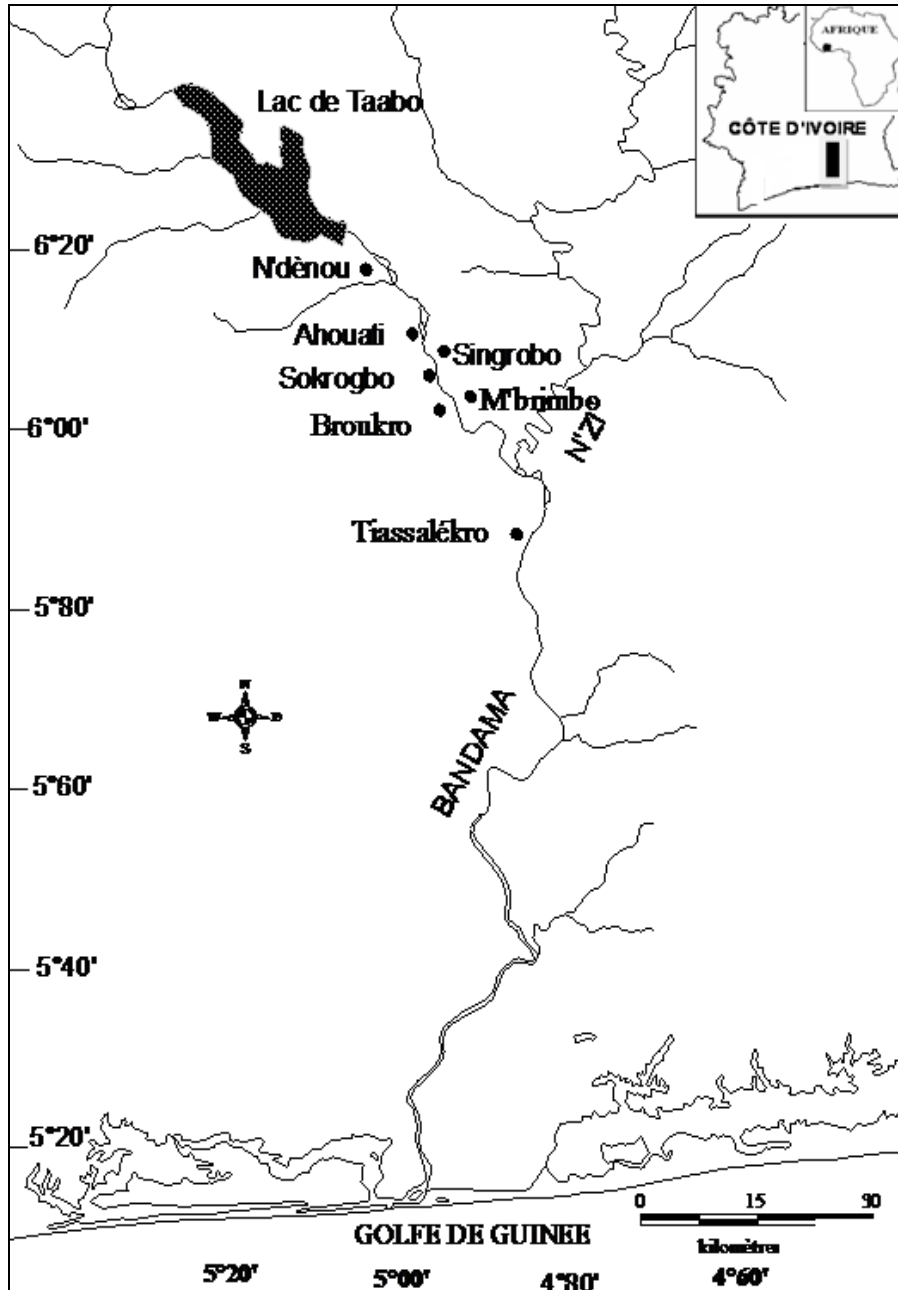


Fig 1: Geographical location of the sampling stations (●)

Direct observation of the facts in the field made it possible to follow the behavior of the various stakeholders in the fishery, their usual practices in the fish markets and to verify the information that was gathered from the questionnaire and the interviews.

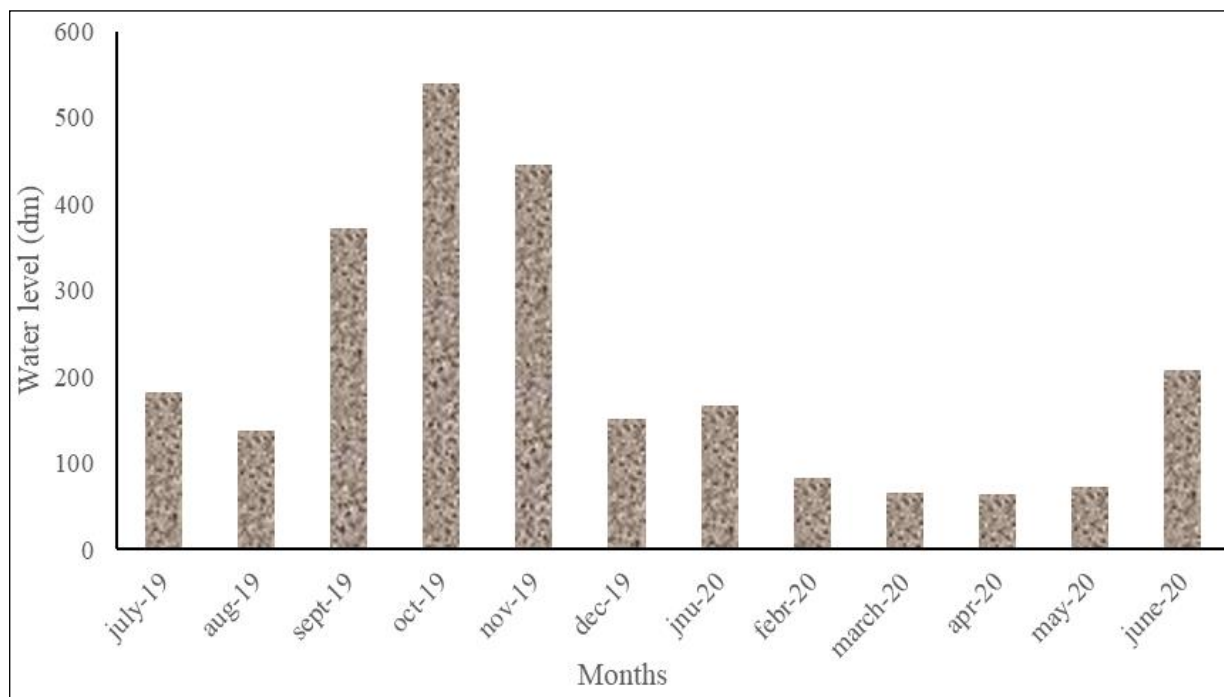
Data processing was done using EXCEL software. The different percentages were obtained by making each time the ratio of the category considered to the total number of all

categories multiplied by 100.

**Results**

**Fishing periods**

The hydraulic regime of the Bandama river determines the different fishing periods in the area of the present study. The monthly average levels of this river are presented in figure 2.



**Fig 2:** Change in water level from July 2019 to June 2020 on the Bandama River. (Source: Directorate of Hydrology of Côte d'Ivoire)

Analysis of figure 2 shows that this regime is influenced by a first, least significant flood in June-July and a second, more marked recession is observed in August. Another most pronounced period extends from December to May. The periods of low water and high water correspond to the different fishing seasons: poor, average and good. Thus, the period from June to July when the water level increases moderately correspond to the average fishing period. From September to November, the water level increases considerably to reach its maximum in October (540 dm), it is the period of maximum flood corresponds to the worst fishing season. It is a period not favorable to fishing activities with low fishing catches everywhere in the fishing areas. During the months of August and December to January, it is the recession, so the water level of the river drops considerably with a minimum in March (65 dm) and April (63.4 dm). This period is very favourable to fishing with good catches, it is the period of good fishing on the Bandama river. Table 1 presents the different catches per unit of effort (kg/trip) by locality.

**Table 1:** Different fishing seasons and quantities of fish caught

Localités	Good saison (kg/trip)	Average saison (kg/trip)	Bad saison (kg/trip)
Taabo	5.66-8.94	4.14-4.55	3.26-3.9
Pacobo	6.4-8.17	4.4-5.3	3.26-3.67
Tiassalé	6.23-11.48	4.59-5.67	3.86-4.03

Analysis of table 1 shows that catch intensity increases to 11.48 kg/trip during the good season. These values decrease

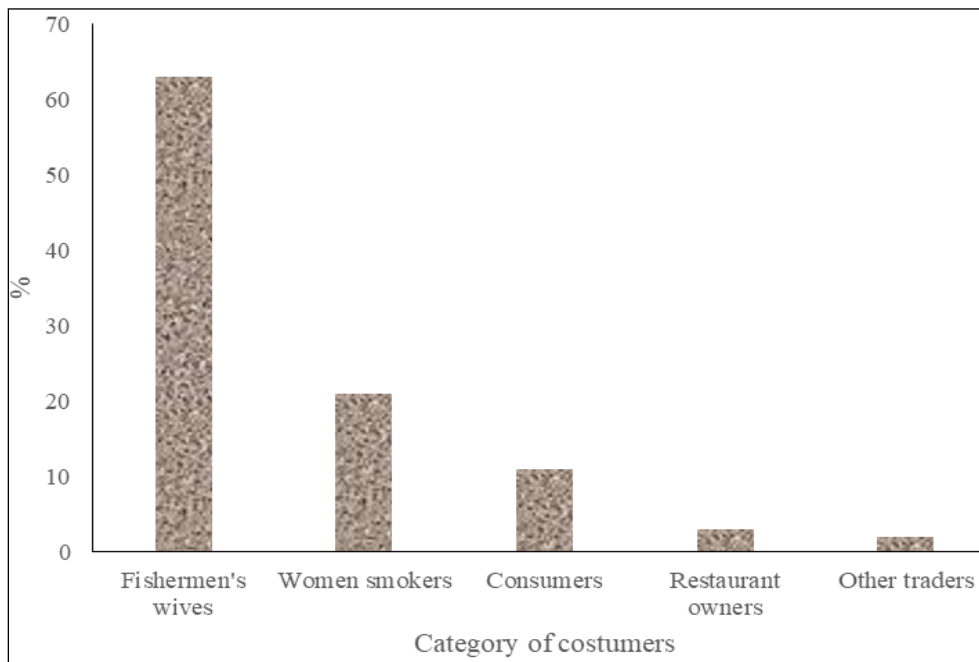
to 4.14 kg/trip during the average season and 3.26 kg/trip during the bad season.

**Marketing of fishery products**

The fish marketing circuit in the study area has several links. As soon as he returns from fishing, the fisherman sells or gives his harvest to the first link in the circuit, his wife or other women. The latter resell the fish to traders who come to wait at their homes. This second group consists of wholesalers and retailers. Nevertheless, some wholesalers take the product directly from the fishermen. These traders, transport the fish to the various markets in baskets or pots for sale. On the various markets, the price of the fish is increased, each group wanting to make the greatest possible profit. Thus, some fishermen entrust the product to their wives for direct sale on the market, either fresh or after smoking, to the various customers. This category of actors assets that this strategy brings them more profits.

**Costumers**

The fishermen’s customers are composed of fishermen’s wives, fish smokers, consumers, restaurant owners and other traders. The distribution of these buyers is shown in figure 3. The analysis of this figure shows that fishermen’s wives (63%) are the priority in the control of fishery products. Next come women smokers (21%) and consumers (11%). Restaurant owners (3%) and the other traders (2%) are the least represented.



**Fig 3:** Different costumers of fishermen

### Role of women in the distribution circuit

In the distribution circuit, women are involved in the post-capture activities of fish processing and marketing. The fish is first delivered to the fishermen's wives who add value to the product. When the product is delivered free of charge to the wife for sale, the fisherman gives indicative prices, but it is she who sets the selling prices to the other customers. This post-capture activities is done in a strictly informal setting. Besides the fishermen's wives who are wholesalers, there are fish sellers and smokers in the villages visited during this study.

### Methods of processing fishery products

The smokers interviewed throughout the area affirm that fish processing is not a choice but a necessity for conservation and profitability, taking into account the taste of consumers. The processing techniques listed in the localities visited are smoking and drying.

### Smoking

Smoking (Photo 1) is a technique that consists of exposing the fish to the action of smoke produced by burning wood. Women usually use metal smoking machines. The smokehouse has an opening on the side, in the lower third, through which the women introduce the firewood that gives the smoke needed to smoke the product. Pieces of circular or rectangular grilling are placed on top of these smokehouses and serve as a support for the fresh fish to be smoked. The observation made in most of the localities visited shows that fish smoking is a family business. This business is made up of the smoker and her workforce, which is made up solely of family members. Some women say that they received the working materials from their mothers and passed them to their daughters. Their apprenticeship in the smoking trade was mainly based on the development of automatism in the processing of fish. These skills have enabled them to become professionals in this field of activity. This professionalism brings them a substantial income which gives them a reputation in society. Some of them cover all their household expenses, others finance the fishermen's activity by granting

them loans. The repayment is made with fish. This strategy is used by these women processors to monopolise the fishermen's production over long periods of time at prices that they negotiate to their advantage. According to our survey results, the profit made per day varies between 15000 and 25000 CFA francs. These sums are well appreciated by the women fish processors, who nevertheless feel that their children should go to school rather than engage in this activity, which exposes them to heat and smoke, skin and eye diseases associated with the lack of institutional credit and difficulties in obtaining fresh fish, which will not guarantee a sustainable activity in a few years.



**Photo 1:** Fish smoking technique at N'denou

### Drying

The drying operation consists of dehydrating the product by exposing it to the sun and air on weel-spread tarpaulins (Photo 2). The fish is thus exposed to natural heat under ambient conditions of temperature and air speed. The fish dries gradually. This method of preservation is generally used for lean fish. This activity, which is less developed than smoking, takes place at home or in sheds built along the roadside and used as a fish market. Some women ferment the fish before exposing it to the sun for drying.



**Photo 2:** Drying fish at N'denou



**Photo 4:** Field-side sale of fish by a fisherman at Taabo

### Marketing of fishery products

This activity is mainly reserved for women (99%). They are fishermen's wives or simple housewives in the study area. The commercialization of fishery products is characterized by the fluctuation of prices on the market. Moreover, there is no text governing this trade. The sale of fishery products allows women to improve their standard of living according to the sales women interviewed. The majority of these women are elderly and have a good experience in this field. The fish is sold in retail or wholesale (Photo 3) on the different markets visited, according to the will of the seller or depending on the period. When they return from fishing, the catches are sold directly to the women. These women, in turn, transform them into finished products before selling them or sell them fresh.



**Photo 3:** Marketing of fresh fish at N'denou

### Sale on site or on the water

This practice, which concerns exchanges between fishermen and traders for the fish caught, is done in two ways. Either the money is given to the fisherman on the spot or on the water or the price is discussed on the spot or on the water (Photo 4) and the fisherman receives the money only after the sale of the fish by the fishmonger. This practice is rarely used in the study area. The majority of fishermen sell their products at home directly to traders or hand them over to their wives for marketing. The selling prices depend on the fishing period, the species, the fishing technique used and the customers. Most of the products caught are marketed (94.5%) and a small part (5.5%) is reserved for the consumption of the fishermen's households.

### Income from fish marketing

The sale of fish is a source of employment and income for the local population. Our survey results show, for example, that a retailer earns an average of 3756 FCFA per day, while a wholesaler earns an average of 12857 FCFA during the bad season. During the good fishing season, the retailer earns a daily average of 8500 FCFA and the wholesaler 23778 FCFA. A retailer earns between 85 000 FCFA and 143 000 FCFA per fishing season. For the wholesaler, the income varies between 300000 FCFA and 500000 FCFA per year. These incomes are considered satisfactory by the women we met, who nevertheless live in precarious conditions. During our meetings with the population, it was noted that the fishing sector also promotes food security and nutrition of the population, especially the poor. The observation made in the field showed rudimentary work equipment with second-hand freezers, basins, baskets, crates and bags. The majority of traders have difficulties in preserving fresh produce. They also estimate that they lose a lot of fish because it is rotten and therefore thrown away. The best profits from fishing are noted during festive periods (New Year, Easter and Independence Day); the presence of a high authority in the area and on weekends. During these periods, which coincide with the presence of consumers with greater purchasing power, products are sold quickly with high profit rates.

### Fate of income from fisheries

The fishermen divide the income from the sale of fish among several sectors of activity. These are schooling of children (35%), agriculture (27.63%), sad events (5%), happy events (7%), purchase of vehicles (11.17%), construction of houses (7.66%), trade (5.03%) and purchase of telephone (1.51%). For the women traders, the income from the sales activity is divided between the acquisition or renewal of work equipment (47%); household expenses (35%); the purchase of fishing gears or its repair for their husband (5%); the purchase of clothes and beauty accessories (3%); saving or loans granted to fishermen (10%). This last part allows them to monopolise the production of the latter out over a long period. Some traders say that they use part of their savings to repay loans taken out by their husband when they have difficulty honouring these commitments. But these cases are very rare.

### Benefits of fishing activities and fish consumption

The people interviewed in this study believe that lack of

means to continue their studies (young people) and the fall in the price of agricultural products (adults) have directed them towards fishing activities for several years. Fishing is the activity that is the most accessible to them to face their financial and food security problems. The fishing activity (harvesting and marketing of fish) occupies hundreds of young people in all the areas visited. On average, there are two or three people working in this sector of activity, either as fishermen, fishermen's helpers or traders of fish products. Apart from these direct jobs, the fishing sectors also offers indirect jobs, particularly in the sale and repair of fishing gear, the manufacture of canoes and the transport of fish. All these jobs allow many people to cover their household expenses.

### Nutritional contribution of fish to health

Fish is recognized as an important source of animal protein for humans in maintaining their balance and health, especially for children and pregnant women. It is true that only the smallest specimens of fish are reserved for household consumption, but this does not hinder their nutritional values in the security of household members. Fish is used daily in the localities visited, in sauces and fried or braised in restaurants. The health agents met during this fishing product favours the good functioning of certain metabolisms and the development of the cells of the body. In addition, the presence of iodine in fish makes this product a means of fighting against diseases related to iodine deficiency. Also, fish is characterized by its richness in amino acids, essential fatty acids, trace elements, vitamins (A, B, D) and minerals (calcium, iodine, zinc, iron).

### 2. Discussion

The importance of inland fishing in the socio-economic development and food security of the local populations of Agnéby-Tiassa region on the Bandama river is described in this study. The results of the present surveys mention hundreds of people living directly or indirectly from the fishing activity. In this regard, the [5] estimates that fishing generates employment for more than 41 million people in the world, jobs created by direct and indirect related activities, provide income, sufficient food resources, healthy food, and foreign exchange for export. The results of this study also show that the fishing activity contributes to ensuring food security for the populations. For example, fish, which is an important source of protein, is accessible to all households. These findings are identical to those presented by [6]. This situation is explained by the fact that in developing countries like Côte d'Ivoire, the price of meat remains beyond the reach of the average consumer [3]. Thus, the fish becomes the primary source of animal protein consumed by the populations. The present study also reveals that fish consumption contributes to the growth and development of the child since the gestation period. This is verified by the fact that during infancy, fish promotes optimal brain development [7, 8]. Furthermore, fish has a biological value comparable to other animal products such as meat and milk (Golé *et al.*, 2005) [9] and provides 150 grams of animal protein, which corresponds to 50-60% of the daily requirement of an adult [8]. In addition, fish is tender, easy to cook and easier to digest than meat. Children and the sick can eat it as easily. Thus, it helps to improve the nutrient intake in these people [10]. It is therefore clear that the contribution of fish to people's diets goes beyond just the quality protein for which it is known. Fish should therefore be an integral component of the diet to

prevent malnutrition by providing the body with easy access to nutrients [7]. In the Agnéby - Tiassa region, a fluctuation in market sale prices depending on the periods is also noted in this study. Kien *et al.* (2017) [11] associate this situation with a non-assessment of the quantities of fish for self-consumption, processing and marketing in the business sector. The random setting of sale prices and the absence of a sale by the kilogram, also testify to the informal character and the organization of fish marketing in the various markets of the Agnéby-Tiassa region. Moreover, this informal character would justify the absence of data concerning the quantities produced, consumed, marketed or offered for a better appreciation of this activity. These observations testify to the lack of reliable statistical data available in this sector of activity [12]; [4]. Nevertheless, the lack of adequate and sufficient technical means at the level of fisheries offices for the collection of these data explains these results (Kien *et al.*, 2018) [13]. Fish, whether fresh, smoked or dried is a product of paramount importance for the populations and for the economy. Its marketing deserves to be controlled to ensure a sustainable business for future generations.

### Conclusion

The fishing sector in the Agneby-Tiassa region on the Bandama river plays a more or less important role in improving the living conditions of the local population. The products of fishing contribute to the food security of the population. Moreover, its capacity to feed people and to provide employment and income from this activity ensures the basic needs of households and allows actores to solve specific problems. It would therefore be very interesting for the managers of continental fishing to think of strategies for a sustainable exploitation of the halieutic resource in Côte d'Ivoire. But despite its contribution to human growth, fishermen sell 94.5% of the products and only about 5.5% is consumed by fishermen's households.

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