IOSR Journal of Agriculture and Veterinary Science (IOSR-JAVS)
e-ISSN: 2319-2380, p-ISSN: 2319-2372.Volume 7, Issue 1, Ver. III (Jan. 2014), PP 56-62
www.iosrjournals.org

Fishermen's Household Characteristics in Bunaken National Park Area, North Sulawesi Province

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Abstract: *This study was aimed at knowing and analyzing the fishermen's household characteristics in Bunaken National Park. It used survey method through structured interviews in order to obtain primary data of the fisheries business owner's and boat crew's households. The secondary ones were also collected from the office of Marine and Fisheries Services at the provincial, regency, and municipality levels for 2006 – 2010, Fishermen's household sampling was carried out with cluster and multi stage random sampling. Results showed that fishing, post-harvest and non-fisheries activities of the owner's household per working period were higher than those of the boat crews. In contrast, the working opportunity of the owner's household in fishing, post-harvest, and non-fisheries was lower than that of crew's household. The average income from fishing, post-harvest, and non-fisheries for the owner's household was higher than that of the crew's household. Based on the average number of the owner's households as many as 3.5 people and of the crew's as many as 3 people, the income per capita was IDR 14.365 million/year or an average of IDR. 1.197 million/month for the owner's household and IDR 4.5 million/year or an average of IDR 0.375 million/month for the crew's household, respectively. This monthly income per capita of the owner's household is above the average minimum wage, while that of the crew's household is below the average minimum wage.*

Keywords: *About fisher, cluster, multi stage, characteristic, household, fishermen.*

I. INTRODUCTION

Bunaken is an area in North Sulawesi Province established as national park with Forestry Minister's decree numbered 730/Kpts-II/1991 covering 89.065 Ha wide. Geographically, it is divided into north part, between 1^0 35' 41" – 1^0 32' 16" N and 124^0 50' 50" – 124^0 49' 22,6"E and south part, between 1^0 24' 0" - 1^0 16' 44" N and 124^0 38' 3" – 124^0 32' 22" E, comprising 4 regency and municipality administrative regions with 24 villages on the island and around the park areas (DTNB, 2010). The physical conditions of the area outside the park, especially Manado city and Minahasa regency, directly bordering with the marine park, are relatively similar to those of Bunaken National Park. These cover topographic, bathymetric, geological, soil and sediment, climatic, oceanographic, and hydrological aspects. Similar situations, but human activity-induced condition difference, occur also for biological, ecological and socio-economic aspects around Bunaken National Park (1).
The presence of fishermen communities around the park areas has influenced the sociological interactions among them in terms of collaboration and competition for natural resources utilization. Based upon the 2010 Bunaken National Park Office, total people in the buffer zone were 27,289 people, those of which were 4,026 fishermen. Their socio-economic structure in the area in 2009 consisted of 1,681 fishermen, those with traditional boats and simple fishing gears, such as line fishing and net, and 3,665 middle class fishermen who were capable of owning outboard motors and operating semi-modern fishing gears, such as trolling, longline, and gillnet, and 28 fishermen who were able to possess inboard engine fishing vessels, such as purse seiners and pole and line (DPK SULUT, 2010) (2).

Bunaken National Park functions as a biodiversity conservation site and supports limited extractive utilization and tourism development. Those three roles are interdependent and supporting one and another as a balance of exploitation and conservation (BTNB, 2010). Fishermen in this area evenly only have fishing opportunities for about 9 months with income range of IDR 250.000 to IDR. 500.000, in which the catch is directly sold for daily needs. Therefore, Bunaken National Park should be coordinatively and participatively managed. The interaction between the potency inside and outside the park needs to be anticipated, managed, and intersectorally controlled**.** Many fishing fisheries-related problems are found in this area, such as low human resources, fishing vessels below 10 Gross Ton (GT), low catches, poor supporting infrastructures, and environmental unfriendly fishing activities causing habitat destructions. Thus, fishermen's economic empowerment in Bunaken National Park area needs to be supported with fishing fisheries development policy**.** It will only be able to achieve by formulating policies in fishing fisheries sector that will then be able to speed up the fisheries and marine development toward source of economic growth.

This study was aimed at knowing and analyzing the fishermen's household characteristics in Bunaken National Park, North Sulawesi. In particular, it was intended to know the work load, the expenditure, and the income of the business owner and the boat crews in Bunaken National Park areas. The study was useful as information for Bunaken Marine Park area management, media for science development and base for policy reconstruction of the park manager.

II. METHODS

This study used both primary and secondary data. The former was taken from the fisherman's households, both the owners and the crews, who have worked in fishing vessels. Each unit of selected fishing vessel was represented by two main executors in fishing activities, the owner and the crew. These data were utilized to describe and study the fishermen's household economic behavior.

Data collection was carried out using cluster random and multilevel sampling according to Deaton's survey methods (Deaton, 1998). This was done through six steps: 1) data were taken from the regencies and municipality around Bunaken National Park, the north of Sulawesi Sea, located in the area of the marine park, such as South Minahasa, Manado municipality, and North Minahasa; 2) chosing the sampling sites from selected regencies/municipality at district level, Tatapaan, Tombariri, Bunaken, and Wori. Each district was selected 3 representative villages, Bajo, Wawontulap and Rap-Rap for Tatapaan district - coastal villages, marine tourism area, dry land, fisheries industries, and no harbor, Poopoh, Kumu and Borgo for Tombariri district - coastal villages, marine tourism, with fish selling site, Tongkaina, Meras, and Molas for Bunaken district - coastal villages, marine tourism, fisheries harbor, dry land and plantation, and Nain, Tiwoho, and Kima bajo for Wori district - marine tourism, fisheries industry, dry land, plantation area, and no fisheries harbor; *3)* randomly selecting the fisheries households and clustering the fisheries business in the sample villages relating to the characteristics of small-scaled fishing gear technology, such as traditional vertical line "*kakintu*", set gillnet and beach seine, used to catch trevallies (*Caranx sp*)**.** In the present study, only "*kakintu*" fisheries was analyzed. Each sample village in the regency/municipality was taken 50 sample respondents who used *kakintu* to represent the fishing gear technology used. Total samples for the four regions were 200 respondents; 4) Since each type of fishing gears has different size and fishing vessels, they have theirown fishing operation boundaries under fishing regulations, so that random sampling was continued on the basis of fishing vessel size (Gross Tonage) for each type of fishing gear*;* 5) For each unit of fishing gear in the study site, the households of the owner fishermen and the crew were selected representing a pair of the household respondents for each unit of fishing efforts. Thus, this study sampled 200 respondents with different socio-economic status, type of villages, gear technology characteristics and vessel size; 6) the household data were collected covering the household and fishing effort characteristics, the use of production factors, productivity and fish production, the household work load, cost, income source and amount, and expenditures for expenses and savings. The latter was collected from Marine and Fisheries Services office at the provincial and regency/municipality level, North Sulawesi, 2006 – 2010 fisheries data, and other data sources, such as villages, districts, BPS (Statistics Centre Office), BAPPEDA (Regional Development Planning Body) and other institutions relating to this study. These data were used to describe the study sites and to determine the exploitation rate of fisheries resources in the area.

III. RESULTS AND DISCUSSION

3.1 Respondent's Household Characteristics

The characteristics of respondent's households covered age, education level and working experience, number of respondent's household members and number of workers in the family of the business owner and the crew in the study site (Table 1).

Mean age was 42 years old for the owners and 44.7 years old for the boat crews, respectively, meaning that they are in the productive age range. Mean education duration was 8.5 years for the owners and 9.2 years for the crews, while their wives had mean education length lower than 6 years for the owner and 7.7 years for the crew. As a whole, age, education length or experience of the crew was longer than the owner.

Mean number of the owner's household economic load was 5.75 people for the family members and 3.5 people for the workers, respectively, while that of the crew's household economic load was 4 people for the family members and 3 people for the workers, so that number of load and workers was larger for the owner than the crew.

Rich production areas in the norhern part of Bunaken National Park were represented by Wori and Bunaken, while those in the southern part were represented by Tatapaan and Tombariri. The owner fishermen were 54.86 years old with 32.3 years experience for Wori, and 42.33 years old with 21.1 years experience for Bunaken, respectively. Those in Tatapaan were averagely younger than 32.52 years old with 10 years experience and those in Tombariri were 27.33 years old with 10.9 years experience, respectively.

3.2 Fish Production

Fishing activities are related with vessel size used, fishing ground, fishing frequency, productivity and varied asset value among the regions. Different vessel size will affect the fishing ground, while catch productivity is influenced by fishng ground and seawater conditions. In high production areas, such as Wori and Bunaken, the local fishermen fished the trevally in traditional way, and thus, the fishing ground was still limited to areas less than 4 miles. Each region had average catches of 200.14 tons per year. Tombariri exhibited the lowest production and Wori did the highest (Table 2).

Furthermore, Tombariri and Tatapaan had fishing frequencies as many as 190 days or six months and 3 days**,** while Wori and Bunaken had average working days of 7 months and 3 days**.** Assumed 18 working days per month, the fishermen in the respondent's locality could maximally work for 10 months.

3.3. Work Load

In spending time, all activities of fishermen's families were grouped into two major activities, economic and non-economic. The former is life supporting activities, fishing or non-fishing, which produce income. The latter is non-income production, such as household management, school, and social and spare time spending activities. Based upon the problems found, this study detailed only the work load for economic activities.

The work load here is defined as number of days given by the workers in the owner or the crew's households to get income from fishing or non-fishing in fisheries or non-fisheries sectors (Table 3). Number of working days for the owner fishermen household on yearly basis was the highest in Wori, reaching 360 days, then Bunaken, 335 days, Tatapaan, 344 days and the lowest in Tombariri, 330 days per year. This high number of working days could result from additional work for fish processing and non-fisheries activities, such as fish drying and agriculture. Wori district had 90 days and 70 days of work load for post-harvest and non-fisheries, respectively. The work was done by 22.5% and 26.25% of the respondents. Additional work for fish processing and non-fisheries activities conducted by Tatapaan owner fishermen were higher 35% and 45% of the respondents.

Working opportunity of the household owners of fishing industries when not going fishing in Bunaken National Park area had two possibilities, a) working a fish processor, fish seller, or agriculture before becoming fishermen and b) working as fishermen, then diversifying the business to fish processing, fish selling and agriculture activities. According to the survey of Bunaken National Park Office (2011), the community conditions in the coastal area of Bunaken National Park were as follows: 8.68% unemployment, 11.09% fisheries sector and 11.05% agriculture.

With availability of working opportunity in the coastal areas, average number of working days for the owner's household was 342.25 days/year. Asumed 28 days/month, the owner's household totally worked less than 12 months, consisting of 58.80% fishing, 21.43% fish processing, and 19.77% non-fisheries. Nevertheless, with worker number-based calculation of the owner's household as many as 3.5 orang, working days per worker were 114.08 days. Assumed working days were 10 months/year, 25 days/month, or 250 days/year, the working days/year/worker were about 45.63% of productive working days available in the owner's household over a year, meaning that there is much spare time available in the owner household.

Work load allocations of the boat crews are different among the districts (Table 4), in which the highest number of working days per year occurred in Tatapaan, followed by Wori and Tombariri, and the lowest was recorded in Bunaken. Number of working days per year is in connection with additional working days of the crew's families for fish processing and non-fisheries activities, such as fish drying and agriculture, as reflected in Tatapaan (63.89% fishing, 22.22% post-harvest, and 13.89% agriculture), Tombariri (59.88% fishing, 12.35% post-harvest, and 27.78% agriculture), Bunaken (62.5% fishing, 28.13 post-harvest, and 9.38% agriculture), and Wori (61.76% fishing, 29.41% post-harvest, and 8.82% agriculture).

With the presence of working opportunity in Bunaken National Park coastal waters, number of days per year for the crew's families to go fishing averagely reached 208.5 days. Given 21 working days/month, the crew's families can totally work for 10 months over a year, consisting of 62.01% fishing, 23.03% post-harvest, and 50% agriculture. However, with worker number-based calculation as many as 3 people, the average working days per person were 70 days. Given number of working days as many as 10 months/year, 25 days/month, or 250 days/year, the working days/person/year in the crew's family were 28% of productive working days available in the family over a year, meaning that there is much spare time in the crew's family, about 72% of the working days usable for the family's productive activities over a year.

3.4 Income

In obtaining revenues, activities of all fishermen's family members were grouped into three sources, from fishing, agroindustrial or post-harvest, and non-fisheries activities. Revenues from fishing were grouped into a) fishing with *katinting* outboard motor boat and b) fishing activity of non-fishing men in the family. The contribution of each economic activitiy among husbands, wives and children to the revenue was not separated

due to various considerations: a) the income post-harvest activities and non-fisheries were overlapping in term of work load allocations among husband, waife and children and b) the use of work load of the husband, wife and children in gaining income from non-fisheries is assumed perfectly substitutive. Under this assumption, the contribution to the revenue of the owner's household from fishing and non-fisheries given in Table 5 indicates number of net profit after cut by the highest fixed depreciation cost of fishing per year for the owner in Tatapaan, IDR. 56,050,000/year, followed by Wori, IDR. 55,040,000/year, Bunaken, IDR. 41,510,000/year and Tombariri, IDR. 28,030,000/year, respectively.

Total income of the owner's household is the total revenues from fishing, post-harvest and non-fisheries activities as given in Table 5, profit from fishing and income from other fisheries activities. The highest total income per year was recorded in Wori, then followed by Tatapaan, Bunaken and Tombariri, respectively. The amount of total income included additional income from fish processing and non-fisheries, such as fish drying and agriculture, IDR. 5.5 million/year and IDR.7,8 million/year in Wori, IDR.4.3 million/year and IDR. 3.6 million/year in Tatapaan, IDR. 3.3 million/year and IDR. 5.2 million/year in Bunaken, and IDR. 2.5 million/year and IDR. 6.8 million/year in Tombariri, respectively. In addition, fish processing and non-fisheries activities for additional income were conducted by all respondents of the owner fishermen in all study sites.

The presence of working opportunities and additional income from non-fisheries in Bunaken National Park areas, average income of the owner fishermen households reached IDR. 60.03 million/year. Income contribution to the owner fishermen from various rural economic activities was 83.23% from fishing, 7.72% from post-harvest and 12.71% from non-fisheries, respectively.

Income sources of the boat crew's household were classified into 4 groups: 1) profit share, the amount of money received by the crew on the basis of profit share in the work site; 2) fish for the day food, the amount of income gained in the form of consumption fish in the work site; 3) other fishing income from non-target catches; and 4) other income from fishing done by other family members (Table 6).

Table 6 shows that the highest crew's yearly income was recorded in Tatapaan, followed by those in Wori, Tombariri and Bunaken, respectively.Total income per year from fish processing and non-fisheries activities, such as fish drying and agriculture, was IDR. 0.63 million/year in Tatapaan and IDR. 0.33 million/year in Wori dan Bunaken, and the lowest was found in Tombariri (IDR. 0.18 million/year) for the post-harvest activity, while for non-fisheries Wori gained IDR. 0.83 million/year, Bunaken IDR. 0.56 million/year, Tombariri IDR. 0.78 million/year and Tatapaan IDR. 0.33 million/year, respectively.

The presence of working opportunities and additional income from non-fisheries in Bunaken National Park resulted in mean total yearly income of the crew's family as much as IDR. 13.56 million/year. Contribution to mean crew's income from various economic activities consisted of 92.64% from fishing, 2.85% from post-harvest, and 5.10% from non-fisheries.

3.5 Costs and Savings

Expenditure allocation of the fisheries business owner is given in Table 7. It is generally lower than the total revenue. The rest was used for two needs, investment and saving. Based on this number, it is apparent that family expenditures of the business owner be in line with the fixed asset depreciation. As a whole, average saving and investment of the business (family) owner in four study sites were IDR. 12.03 million and IDR. 48.32 million, respectively. These numbers are higher than those of total fixed asset depreciation of the fishing vessel.

It indicates that the household behavior of the owner fisherimen is generally rational and thrifty. They typically manage their household's expenditures with the amount of profit and other revenues from agoindustrial and non-fisheries activities.

Living cost and saving relative to the income level of the fishermen's household is given in Table 8, in which number of living cost in the fishermen's household is generally lower than their total revenue. In general, the fishermen save by purchasing gold ornaments. They combined fulfilling their satisfaction for non-major need (jewelry) and save for future needs in the form of precious jewelry.

IV. TABLES

Table 1. Household characteristics of the owners and the crews in each study site**.**

Household Characteristics	Bunaken National Park				
	Tatapaan	Tombariri	Bunaken	Wori	Mean
1. Owner					
Mean Age (Year)	27.33	32.52	42.33	54.86	42
Length of education (Year)	8.36	8.52	7.32	7.24	8.5
Length of education and experience (Year)	7.1	13.4	21.1	32.3	22.5
Experience (Year)	10.9	10.0	8.2	8.4	8.5
Wife education length (Year)	7	5	6	3	5
No. Household members (people)	5	6	8	4	5.75

No. workers (people)	2	3	4	5	3.5
2. Boat Crew					
Mean age (Year)	47.69	43.7	38.8	48.8	44.7
Education length (Year)	7.6	10.9	10.0	8.2	9.2
Education length and experience (Year)	29.0	26.1	19.8	31.5	26.6
Wife education length (Yr)	8.5	7.3	7.2	7.6	7.7
No. Household members (people)	5	3	4	5	4
No. workers (people)	3	3	3	3	3

Table 2. Production Activity Characteristics of The Respondent Fishermen.

Production Activities	**Tatapaan**	**Tombariri**	**Bunaken**	**Wori**	**Mean**
Asset Value (IDR. million)	12	13.1	12	14.3	12.85
Vessel Size (GT)	0.6	0.7	0.5	0.8	0.65
Fishing Ground (Km)	7.2	6.4	8.2	6.6	7.1
Fishing Frequency (day)	194	190	220	200	201
Productivity (Kg/Trip)	0.059	0.05	0.072	0.201	0.0955
Catch (Ton/year)	150.89	101.38	135.93	412.36	200.14

Table 3. Work load of the owner's fishermen household in each study site (day/year)

Economic Activities	**Tatapaan**	**Tombariri**	**Bunaken**	**Wori**	**Mean**
1.Fishing (day)	194	190	220	200	201
Percent (%)	56.40	57.58	65.67	55.56	58.80
2.Post-harvest (day)	90	50	65	90	73.75
Percent (%)	26.16	15.15	19.40	25	21.43
3.Non-fisheries (day)	60	90	50	70	67.5
Percent (%)	17.44	27.27	14.93	19.44	19.77
4.Total Working Days	344	330	335	360	342.25
5.Working Opportunity					
a. Post-harvest (%)	35	17.5	15	22.5	22.5
b. Non-fisheries (%)	45	22.5	12.5	25	26.25

Table. 4. Work Load of Crew's Household (days/year)

Economic Activities	**Tatapaan**	**Tombariri**	**Bunaken**	**Wori**	**Rerata**
1. Fishing (days)	230	194	200	210	208.5
Percent (%)	63.89	59.88	62.5	61.76	62.01
2.Post-harvest (days)	80	40	90	100	77.5
Percent (%)	22.22	12.35	28.13	29.41	23.03
3.Non fisheries (days)	50	90	30	30	50
Percent (%)	13.89	27.78	9.38	8.82	14.97
4.Total Working Days	360	324	320	340	336
5.Working Opportunity					
a. Post-harvest (%)	45	12.5	37.5	50	36.25
b. Non-fisheries (%)	20	30	25	42.5	29.38

Table 5. Owner's household income from fishing and non-fishing (IDR. Million/year)

Income	Tatapaan	Tombariri	Bunaken	Wori	Rerata
1.Fishing					
Income	93.42	46.71	69.18	91.73	75.26
Depressiation	37.37	18.68	27.67	36.69	30.10
Profit	56.05	28.03	41.51	55.04	45.16
2.Other fishing	5.5	4.4	6.9	3.7	5.13
3.Income from fishing	61.55	32.43	48.41	58.74	50.28
Percent (%)	88.63	77.71	85.06	81.54	83.23
4.Post-harvest	4.3	2.5	3.3	5.5	3.9
Percent (%)	6.99	7.71	6.82	9.36	7.72
5.Non-fisheries	3.6	6.8	5.2	7.8	5.85
Percent (%)	5.85	20.97	10.74	13.28	12.71
6.Total Income	69.45	41.73	56.91	72.04	60.03

Table 6. Crew's household income from fishing and non-fishing (IDR. Million/year)

Income	Tatapaan	Tombariri	Bunaken	Wori	Mean
1. Income Share	12.64	9.44	9.22	12.23	10.88
2. Consumption Fish	0.7	0.7	0.7	0.7	0.7
3. Fishing crews	0.5	0.55	0.65	0.45	0.54
4. Other fishing activities	0.45	0.35	0.45	0.55	0.45
5. Fishing Income	14.29	11.04	11.02	13.93	12.57
Percent (%)	93.70	92	92.53	92.31	92.64
6. Post-harvest	0.63	0.18	0.33	0.33	0.37
Percent (%)	4.41	1.63	2.99	2.37	2.85
7. Non-Fisheries	0.33	0.78	0.56	0.83	0.625
Percent (%)	2.31	7.07	5.08	5.96	5.10
8. Total Income	15.25	12	11.91	15.09	13.56

Table 7. Expenditure allocation for daily needs, investment, and saving of the business owner family (IDR million/year)

No	Type of Expenditures and Revenues	District				
		Tatapaan	Tombariri	Bunaken	Wori	Rerata
1	Expenditures:					
	Food Consumption	18.3	10.98	12.81	20.13	15.56
	Non-food Consumption	10.98	6.59	7.69	12.08	9.33
	Main Consumption	29.26	17.57	20.50	32.21	24.88
	Non-main Consumption	5.85	3.514	4.10	6.44	4.98
	Total Consumption	35.11	21.084	24.60	38.65	29.86
2	Investment	14.34	7.87	11.91	14.02	12.03
3	Savings	57.37	31.46	47.65	56.78	48.32
4	Total Revenue	69.45	41.73	56.49	72.04	59.93
5	Total Expenditure (Depreciation)	37.37	18.68	27.67	36.69	30.10

Table 8. Expenditure Allocation for crew's household consumption and savings (IDR. Million/year)

No	Types of expenditure and revenue	District				
		Tatapaan	**Tombariri**	**Bunaken**	**Wori**	**Mean**
1	Expenditures:					
	Food Consumption	5.49	5	4.56	7.32	5.72
	Non-food Consumption	2.20	2.20	1.82	2.93	2.29
	Main Consumption	7.69	7.69	6.38	10.25	8.00
	Non-main Consumption	1.54	1.54	1.28	2.05	1.60
	Total Consumption	9.22	9.22	7.66	12.30	9.60
2	Investment					
3	Savings	6.03	2.78	4.25	2.79	3.96
4	Total Revenue	15.25	12	11.91	15.09	13.56
5	Total Expenditure (Depreciation)					

V. CONCLUSION

Work load for fishing, post-harvest, and non-fisheries per worker in the owner's family was higher than those in the crew's family, in which there are 45.63% and 28% of productive days per year for the owner's family and the crew's family, respectively, meaning that there is much spare time for them and thus, the working opportunities for fishing, post-harvest, and non-fisheries for the owner family are less than those for the crew's family. The average income of the owner's family is about 4 times higher than that of the crew's one. It is indicated by average number of family members as many as 3.5 people for the owner and 3 people for the crew with monthly income of Rp 1.197 million/person for the owner's family member and Rp. 0.375 million/person for the crew's family member. It is above the 2011 regional minimum wage of North Sulawesi Province for income/capita/month of the owner's household, but below the regional minimum wage for income/capita/month of the crew's household. Moreover, the household behavior of the owner and the crew in Bunaken National Park area could be classified as rational and thrifty. Both the owner's and the crew's families have a saving habit. Nevertheless, the average consumption rate of the crew's family for food and non-food is much lower than that of the owner's family, and it would have impact on the quality of their human resources.
The yearly saving of the owner's household is much higher than that of the crew's household. However, there are other expenditures of the owner for investment, such as fishing gear maintenance or addition, and it will also affect the prosperity development of the owner and the crew. Under this consideration, the policy-related crucial problem in fishermen's prosperity development and distribution is the increasing discrepancy between the owner's and the crew's household prosperity.

To develop fishermen's household economic model in Bunaken National Park area in relation to various choices of policies in sustainably raising the fishermen's household production and prosperity, there are many related factors: 1) sustainable resources utilization (*MSY*) through fishing ground extention, 2) technology and vessel asset size development, 3) building human resources capability, 4) ideal income distribution, and 5) increase in non-fisheries work load as alternative income source from post-harvest and non-fisheries activities, and then, simultaneously putting it in an integrated linkage in a fishermen's household economic behavioural similarity system of Bunaken National Park area.

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