

QUANG NGAI RURAL DEVELOPMENT  
PROGRAM (RUDEP) - PHASE 2

Potential of Aquaculture Development to Support  
Income Generation of the Poor in Quang Ngai  
Province



VIET NAM-AUSTRALIA

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## Acronyms

|       |   |
|-------|---|
| ACIAR | Australian Centre for International Agricultural Research |
| AES   | Agriculture Extension Station                             |
| DoF   | Department of Fisheries                                   |
| FEC   | Fisheries Extension Centre                                |
| FSC   | Fisheries Seed Centre                                     |
| GoV   | Government of Vietnam                                     |
| MRD   | Mekong River Delta  |
| RUDEP | Quang Ngai Rural Development Program                      |
| VND   | Vietnamese Dong   |

# 1 Introduction

The Quang Ngai Rural Development Program (RUDEP) is funded by the Australian Government and the Vietnamese Government (GoV) aimed at rural development and poverty reduction in selected communes in Quang Ngai Province. RUDEP has four main components: income generation activities; small-scale infrastructure; capacity building; and management and monitoring and evaluation. Cycle 1 started in 2001, the Program was implemented in three Communes of Son Hai (Son Ha District), Tinh Tho (Son Tinh District) and Duc Phong (Mo Duc District). Cycle 2 started in August 2002, the program expanded its activities into three more Communes of Nghia Tho (Tu Nghia District), Pho Chau (Duc Pho District) and Hanh Phuoc (Nghia Hanh District).

During participatory planning process in the target Communes and Districts, aquaculture practice has been raised as means to support income-generation for households.

The objective of the mission was to identify the potential of aquaculture development to support income generation to poor farmers. To identify the potential, field visits were made between 18 to 29 August 2003 in Quang Ngai Province to target communes of RUDEP, contacts made with relevant institutions, and discussions held with key informers (see Annex 1, Time Schedule).

## 2 Potential and Current Status of Freshwater Aquaculture of Quang Ngai Province

Quang Ngai Province was split from the former province of Nam Ngai Dinh in 1989. Due to narrow and steep topography features, the province has very few natural lakes for freshwater aquaculture but it has a dense network of dams and reservoirs distributed on all regions - low, middle and uplands. If properly invested this should offer great advantages for freshwater aquaculture development. In addition to these water bodies, many small earthen ponds are excavated in all districts of the province. Other factors favourable for freshwater aquaculture development in Quang Ngai are as follows.

- The Thach Nham irrigation system provides good water source for fish culture in lowland districts.
- Good transportation system makes aquaculture products accessible to remote areas in the province.
- Having good service of fish seed provision.

However the province faces many constraints for freshwater aquaculture development as follows:

- Many areas are flooded during the rainy season and encounter drought during the dry season. Flooding usually occurs during October-December period each year.
- During the year, there is a period (from November to February) of low temperature (below 20°C), which is unfavourable for growth of aquatic animals, particularly in mountainous areas.
- There is big competition of marine products to freshwater fish in markets in terms of abundance and prices.

In recent years, freshwater aquaculture has been relatively developed in all eco-agricultural zones – plain, midland and mountain - with different water bodies – ponds, reservoirs and natural swamps - of the province. The total area of freshwater aquaculture of Quang Ngai in 2001 was 550 ha with an average yield of 440 kg.ha<sup>-1</sup>.year<sup>-1</sup> and a total estimated production of 245 mt. The product was only for domestic markets. The freshwater fish culture has been developed fairly fast in five mountainous Districts of Ba To, Minh Long, Son Ha, Son Tay and Tra Bong. In 2001 there were more than 500 households practicing fish culture in these districts (Table 1). Fish culture operation has been proven to be a good means to improve nutrients and to generate incomes to these households.

**Table 1: Status of Freshwater Aquaculture of Quang Ngai Province in 2001**

|    | District/Town   | Fish Culture Household no. | 2001      |                              |                 |
|----|-----------------|----------------------------|-----------|------------------------------|-----------------|
|    |                 |                            | Area (ha) | Yield (mt.ha <sup>-1</sup> ) | Production (mt) |
| 1  | Binh Son        | n.a                        | 7         | 1                            | 7               |
| 2  | Son Tinh        | n.a                        | 15.5      | 0.77                         | 12              |
| 3  | Tu Nghia        | n.a                        | 3         | 1                            | 3               |
| 4  | Mo Duc          | n.a                        | 104       | 0.23                         | 24              |
| 5  | Duc Pho         | n.a                        | 378.5     | 0.14                         | 56              |
| 6  | Nghia Hanh      | 30                         | 5         | 0,8                          | 4               |
| 7  | Ba To           | 140                        | 12        | 2.75                         | 33              |
| 8  | Minh Long       | 142                        | 13        | 3                            | 39              |
| 9  | Son Ha          | 80                         | 4         | 4                            | 16              |
| 10 | Son Tay         | 54                         | 1.5       | 1.2                          | 1.8             |
| 11 | Tra Bong        | 60                         | 6.5       | 2.7                          | 17.5            |
| 12 | Quang Ngai Town | n.a                        | n.a       | n.a                          | n.a             |
|    | Whole province  | 506                        | 550       | 0.38                         | 213.5           |

Note: n.a = not available

The freshwater aquaculture systems being practiced in the province are mainly fish culture in earthen ponds, dams and reservoirs. Polyculture with Chinese carp (grass carp (*Ctenopharyngodon idellus*), silver carp (*Hypophthalmichthys molitrix*), and bighead carp (*Aristichthys nobilis*)), common carp (*Cyprinus carpio*), tilapia (*Oreochromis niloticus*) and Indian major carps is common. The cultured fish in ponds is fed mainly with on-farm agriculture by-products (rice bran, vegetable residues, cassava leaf, wide grass, dry cassava root). No feed is provided for the fish cultured in dams and reservoirs. Fish cultured in ponds is utilised by households and extra marketable fish is sold locally. Harvested fish from dams in small amounts is also sold locally. However, the fish harvested from dams or reservoirs in large amounts is transported by middlepersons to sell to the neighbouring province, Gia Lai.

The recent development of freshwater aquaculture of the province has been contributed by Department of Fisheries (DoF) and its agencies. In 2002, to promote freshwater aquaculture, DoF established several demonstrations with new fish species and systems. In March 2003, the DoF signed an Agreement with Vietnamese Sea-product Export General Company (Seaprodex) on tilapia culture for export. This Agreement has been implemented by different DoF's agencies.

## 2.1 Fisheries Extension Centre (FEC)

The provincial Fisheries Extension Centre (FEC) is responsible for technique transfer on fisheries. The FEC has 12 staff, of which four are trained in aquaculture. Freshwater aquaculture service is assigned for two staff, one of them has been newly contracted. The common method applied to transfer technique of fish culture to farmers is farmer training. The FEC staff

collaborates with district Agricultural Extension Station/Centre and commune staff to organise the training course. During a training course, the trainer gives an oral presentation of a whole package of fish culture. Training aid materials are black or white board and colour chalk or pen. The farmers attending the training are provided an extension booklet with black printing text and illustrated drawings. They are also provided an amount of bonus money of 15,000 VND. No assessment of efficiency is done during and after the training course. Every year the FEC organises about 10 training courses on fish culture for about 500-600 farmers in 5 mountainous districts. The FEC also provides fish seed to establish 15-20 demonstrations of fish culture in ponds in these districts.

In 2001, the FEC released broodstock of sand goby (*Oxyeleotris marmoratus*) into several man-made water bodies (Dap Lang dam, Liet Son reservoir to restore aquatic resources. The efficiency of this operation is still being reviewed.

In 2002, one demonstration of tambaqui fish (*Colossoma brachypomum*) cultured in a pond was established in Hanh Phuoc Commune of Nghia Hanh District. The other demonstration of sex-reversed male red tilapia (*Oreochromis sp.*) cultured in a pond was also established in Duc Lan Commune of Mo Duc District. None of these demonstrations have been reviewed on technical and economic efficiency. Again, the expansion of these demonstrations is still questioned. In addition to these, the district Agriculture Extension Station (AES) of Mo Duc established one demonstration of rice-fish system with sex-reversed male red tilapia in Duc Thanh Commune in 2003. The fish is fed with homemade feed with different materials followed guideline from the station staff. Most of these materials are purchased from the market. The demonstration is still going on. Even the fish grow quite well but the failure of the whole system in terms of technical and economic efficiency has been foreseen.

## 2.2 Fisheries Seed Centre (FSC)

Another agency of the DoF, the Fisheries Seed Centre (FSC), was established in 2002 with the duties of production of fisheries seed, transfer aquaculture technology and aquatic animal gene conservation. FSC has different production facilities: six marine shrimp hatcheries, one freshwater fish hatchery, 2.7 ha of grow-out shrimp ponds, two reservoirs for enhanced fish culture.

The FSC Duc Pho fish hatchery raises fingerlings of freshwater fish species and has a production capacity of about 1 million fingerlings per year. The hatchery also purchases around two million fingerlings to sell to fish farmers in the province.

The FSC is assigned as one of the units to culture tilapia for export based on the Agreement signed by the DoF and Seaprodex. FSC has also carried out several researches on fish and shrimp culture.

The FSC staff report that during the last ten years the demand for fish fingerlings has been increasing by about 10 per cent each year. The small-scale fish culture has been developed in five mountainous districts and significantly contributed to nutrient improvement and income generation of the fish culture households.

### 3 Planning Freshwater Aquaculture Development of Quang Ngai Province

In August 2002, a General Plan for Aquaculture Development of Quang Ngai Province for 2002-2010 Period was developed by the DoF and approved by the provincial People's Committee. The objectives of aquaculture development planning are as follows:

- Proper and efficient exploitation of potentials of land and water surface for contributing to hunger eradication and poverty reduction, creating conditions for getting rich, developing socio-economic status of the province, providing materials for processing and export on the principles of sustainable development and ecological environment protection.
- Planning marine, brackish water and freshwater aquaculture on existing culture zones - tidal, dune, river vicinity, coastal and saline contaminated lands, reservoirs, natural swamps, etc. - identifying cultured species and orienting technical solutions suitable for each zone.

The targets of freshwater aquaculture development set by the plan are identified as:

- The area potential of freshwater aquaculture is 2910 ha comprised 482 ha of small ponds and 2428 ha of dams and reservoirs;
- The area of freshwater aquaculture is 700 ha with a total production of 640 mt by the year of 2005; and
- The area of freshwater aquaculture is 1337 ha with a total production of 1360 mt by the year of 2010.

**Table 2: The Targets of Freshwater Aquaculture Development of Quang Ngai Province**

|    | District/Town   | Potential area (ha) | 2005      |                 | 2010      |                 |
|----|-----------------|---------------------|-----------|-----------------|-----------|-----------------|
|    |                 |                     | Area (ha) | Production (mt) | Area (ha) | Production (mt) |
| 1  | Binh Son        | 625 (50+575)        | 70        | 70              | 132       | 200             |
| 2  | Son Tinh        | 246 (50+206)        | 22        | 22              | 80        | 79              |
| 3  | Tu Nghia        | 22 (15+7)           | 5         | 7               | 10        | 15              |
| 4  | Mo Duc          | 330 (60+270)        | 125       | 50              | 178       | 110             |
| 5  | Duc Pho         | 620 (70+550)        | 400       | 200             | 500       | 300             |
| 6  | Nghia Hanh      | 70 (20+50)          | 10        | 20              | 15        | 30              |
| 7  | Ba To           | 380 (50+330)        | 16        | 48              | 150       | 300             |
| 8  | Minh Long       | 70 (50+20)          | 17        | 53              | 20        | 60              |
| 9  | Son Ha          | 200 (40+160)        | 15        | 20              | 135       | 130             |
| 10 | Son Tay         | 40 (30+10)          | 10        | 25              | 25        | 36              |
| 11 | Tra Bong        | 300                 | 8         | 49              | 85        | 80              |
| 12 | Quang Ngai Town | 7                   | 2         | 2               | 7         | 7               |
|    | Whole province  | 2910                | 700       | 616             | 1337      | 1347            |

Note: The former value in brackets is of small ponds and dams, the latter of reservoirs

To implement the aquaculture development plan successfully, particularly for freshwater aquaculture, it is necessary to take into account all relevant advantages and constraints mentioned above. Moreover, according to the fish culture farmers in Quang Ngai Province, the suitable period for easily selling freshwater cultured fish is during November-February period when marine fish supply is reduced due to rough sea. The relevant factors of freshwater aquaculture development are presented in Table 3.

**Table 3: Factors Affecting Freshwater Aquaculture in Quang Ngai Province**

| Month                  | 1          | 2 | 3             | 4      | 5 | 6 | 7 | 8 | 9            | 10     | 11   | 12 |
|------------------------|------------|---|---------------|--------|---|---|---|---|--------------|--------|------|----|
| <b>Seasons</b>         | <b>Dry</b> |   |               |        |   |   |   |   | <b>Rainy</b> |        |      |    |
| Flood                  |            |   |               |        |   |   |   |   |              |        |      |    |
| Air temperature (T°C)  | < 30°C     |   |               | > 30°C |   |   |   |   |              | < 30°C |      |    |
|                        | Cold       |   |               |        |   |   |   |   |              |        | Cold |    |
| Selling FW fish        | Easy       |   |               |        |   |   |   |   |              | Easy   |      |    |
| FW fish culture period |            |   | Most suitable |        |   |   |   |   |              |        |      |    |

Combined those factors, the most suitable period for freshwater fish culture is from March to September months. It should be noticed here the time for harvesting does not coincide with the period for easily selling products. It is required to have methods to protect fish during flooding time for higher price.

## 4 Potential for Aquaculture to be Practiced as Means of Income Generation

As mentioned above, the potential for freshwater aquaculture development, mainly fish culture, in Quang Ngai Province in general and the target Communes and Districts in particular is relatively high. Even there is a prevalent thinking of having no market for freshwater cultured fish of contacted staff, fish culture area has been increased for the last few year and reached to 550 ha in 2001. Freshwater fish culture operation of the province is practiced mainly in earthen ponds and dams and reservoirs. The pond system is normally managed by households whilst enhanced fishery in the dams and reservoirs by individuals or groups of farmers.

### 4.1 Fish Culture in Ponds

In communes visited, fish ponds are excavated near houses or ditches dug to get soil for making dykes of the Thach Nham irrigation system. Water source is from rainfall (in Tinh Tho and Son Hai communes) or irrigation system (in Duc Phong, Tinh Tho and Hanh Phuoc communes). Pond water level is maintained about 1-2 m depending on water sources. Polyculture with Chinese carps, common carp and tilapia is commonly applied. Stocking density is low, around 2 fish/m<sup>2</sup>. Grass carp is stocked at 50% of cultured species. The fish is fed with on-farm agriculture by-products. To develop natural feed, the fishpond is sometime fertilised with manure (mainly cattle manure). Chemical fertilizer is rarely used for the fishpond. The integrated farming system namely VAC is not practiced sufficiently (poor relationship among the three components). Multiple harvesting is practiced passively due to the problem of selling. Most of the fish culture farmers have been accessed to extension service. All on-going fish cultured farmers met during the mission have confirmed profits of their operation.

Constraints facing fish culture farmers can be identified as follows:

- Lack of technical know-hows and skills.

This might be the biggest constraint for successful fish culture operation. Lack of technical know-hows and skills can be seen through existing culture performance. Even polyculture of different fish species for best use of the natural feed in ponds is applied but combination ratio of cultured species is inappropriate. The high ratio 50% of grass carp (a herbivore with high feeding rate) can cause problem of water pollution. Grass carp is very sensitive to red spot disease which has been a cause of big loss to the fish culture farmers in Northern Vietnam. Fertilising the fish ponds with manure (mainly cattle manure) is sometimes applied to develop natural feed. The cattle manure is high in carbon content but low in nitrogen. It should be applied with urea supplementation. The fish culture farmers have not done this.

- Lack of fund for improving ponds and buying seed.
- Lack of water during long drought in dry season and pond overflowed during flooding.
- Time consuming for selling cultured products.
- Difficult to protect cultured fish from electric fishing people.

Development of small-scale fish culture in ponds should be considered as priority to support income generation of the Program. There are more than 500 households practicing pond fish culture in mountainous area (Table 1). The data of number of fish culture households in the plain area have not been recorded but it seems to be high in some communes of Son Tinh and Nghia Hanh districts.

Polyculture of different fish species should be applied for better use of on-farm agriculture by-products. Tilapia is one of the main cultured species of polyculture method in southeastern and southwestern (Mekong River delta) provinces. Tilapia is uncommonly cultured in the province since the poor quality of local strain results in small marketable size of the food fish. Due to good characteristics of tilapia (high growth rate, simple feed requirement, high withstanding to the poor conditions of culture environment, good tolerance to diseases), the genetically improved strain of tilapia namely GIFT fish should be introduced into the pond system. Simple technique of tilapia seed production locally could be promoted later. With the hydrographic conditions of Quang Ngai Province, the time for fingerling stocking should not be later than March and the time for product harvesting should be in September, prior flooding time.

The fish culture farmers need to have access to the extension service. The FEC, FSC and AES could be agencies to provide the service. However, the approach of fish culture on-farm trial should be applied to produce appropriate recommendations. The other approach of Farmer Field School on fish culture is also valuable to be practiced to create the participation of the farmers in fish culture development planning. But first, some VAC demonstrations could be established in Son Tinh and Hanh Phuoc communes under the program activities.

To develop small-scale fish culture in the future, the poor farmers need supports to access credit systems to invest for pond construction, particularly in the mountainous area. The capital investment of VND800,000 for one 70-m<sup>2</sup> pond was found in Son Hai Commune of Son Ha District.

## 4.2 Fish Culture in Dams and Reservoirs

Quang Ngai Province has great potential for area-large-scale fish culture development with a network of 81 dams and reservoirs (1670 ha) distributed in all districts, particularly in Duc Pho and Son Tinh districts. These water bodies are managed by local governments or irrigation institutions. Most of them are assigned to individuals or groups of farmers or agencies (namely fish culturists) by nominating or bidding to culture fish. The nominators or bidding winners only stock fingerlings without feeding. The common fish species stocked in the dams and reservoirs are Chinese carps, common carp, Indian major carps, silver barb and tilapia. The yield is depended on trophic status of the water bodies, ranged from 71 kg/ha (Liet Son reservoir in Duc Pho District) to 750 kg/ha (Mach Dieu reservoir in Mo Duc District). The yield of dam and reservoir fish culture is also depended on the efficiency of methods to prevent fish escape due to overflow during rainy season. In general, most of the fish culturists got profits from this operation.

If local governments have policies to assign these water bodies to the poor, fish culture may help reduce their poverty, particularly in mountainous areas. The technical issues of fish culture in

small dams and reservoirs could be consulted from the Australian Centre for International Agricultural Research (ACIAR)-funded Project of Culture-based and capture fisheries development and management in reservoirs, implementing in the country.

### 4.3 Integrated Rice-Fish System

Rice-fish system is being applied commonly in the Mekong River delta (MRD) due to its great benefits, e.g. increased rice yield, less use insecticides, good use of natural feed by fish, higher economic efficiency, and profitable for environment and human health. One important condition to apply the system is convenience of paddy field water exchange. Water source is not contaminated with harmful substances (pesticides, heavy metals). Hydrographic regime which is affected by tidewater makes the MRD suitable to apply the system.

The demonstration of rice-fish system carried out in the Duc Thanh Commune has not followed principals of the system implementation: monoculture instead of polyculture, purchased feed materials instead of on-farm by-products.

The irrigation system of Thach Nham provides a potential to develop the rice-fish system in Quang Ngai Province. Sites to apply the system should be carefully selected to fulfill the condition mentioned above. The size of rice paddy field should large enough, e.g. 2000 m<sup>2</sup> up, to take advantage of economic scale. The fish species of silver barb (*Bardodes gonionotus*), common carp, GIFT, rohu (*Labeo rohita*) are suitable for the rice-fish system. Again, in the context of Quang Ngai province, the time for fingerling stocking should be in March and the time for product harvesting should be in September, prior flooding time.

#### **Recommendation:**

One demonstration of rice-fish system can be established in Duc Phong Commune of Mo Duc District. The selected site can be the rice paddy fields in front of the CPC office where the water in the fields can be exchanged easily through supply and drainage canals.

### 4.4 Potential Cultured Fish Species

In addition to the common fish culture species, there are two new species that have been introduced to Quang Ngai Province recently, tampaqui fish (Vietnamese name *ca chim trang*) by the FEC and Mekong river catfish (Vietnamese name *ca tra*, *Pangasius hypophthalmus*) by provincial VETEX company. The latter can be found in the Quang Ngai Town market. These species could be only cultured with other species in a polyculture system with a low ratio until the market for them becomes clearer.

## 5 Conclusions and Recommendations

The potential systems of fish culture development for income generation of the poor in Quang Ngai Province is diversified.

The following **demonstrations** could be established under the RUDEP activities for further expansion as follows:

- Small-scale fish culture in VAC system in Hanh Phuoc Commune of Nghia Hanh District and Tinh Tho Commune of Son Tinh District. based on:
  - polyculture of Chinese carp, common carp and GIFT;
  - utilisation of on-farm agriculture by-products as main inputs; and
  - the culture period from January to September.
  
- Integrated rice-fish system in Duc Phong Commune of Nghia Hanh District. based on:
  - Site selected with non-polluted water source and convenient water exchange;
  - Polyculture of Chinese carp, common carp and GIFT;
  - Utilisation of on-farm agriculture by-products as main inputs; and
  - Suitable culture period from January to September.
  
- Fish culture in dams and reservoir to be operated by the poor in Duc Pho and Son Tinh Districts if the following conditions are met:
  - The local governments have policy to assist the poor to obtain right of using the water bodies; and
  - The local governments or other source can assist the poor to access credit systems to invest into fish culture operation.

For sustainable development of freshwater aquaculture, capacity building to the FEC, AES, extension volunteers in communes and fish culture farmers should be trained through offering study tours and short training courses.

The study tours should be organised to visit rice-fish system in MRD provinces, FFS in fish culture of AIT-Aqua Outreach Program in Southeastern provinces. The short training courses should be on basic aquaculture, new extension approaches.

## **Annex 1**

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### **Time Schedule**

## Annex 1: Time Schedule

| Day | Morning Activity   | Afternoon Activity   | Overnight Location |
|-----|--|--|--------------------|
| 17  |  | Arrival at the Quang Ngai Province   | Hung Ha 2 Hotel    |
| 18  | Visit to the RUDEP office to learn about RUDEP   | Visit to the QN Department of Fisheries (DoF) office to learn about Aquaculture Development Plan of the province           | Hung Ha 2 Hotel    |
| 19  | Visit to the QN Fisheries Extension Center (FEC) office to learn about capacity of the center on fisheries extension service   | Visit to the QN Fisheries Seed Center (FSC) office to learn about its activities on seed supply                            | Hung Ha 2 Hotel    |
| 20  | Visit to Duc Phong commune of Mo Duc district to learn about ideas of the local authority on aquaculture development<br><br>Visit to demonstrations of rice-fish system in Duc Thanh commune and fish pond system in Duc Lan commune | Visit to QN FEC office to learn about needs of the center for extension service efficiency                                 | Hung Ha 2 Hotel    |
| 21  | Working at the RUDEP office to read collected references<br><br>Visit to Quang Ngai market to search for markets of FW cultured fish   | Visit to different fish culture systems in Tinh Tho commune of Son Tinh district   | Hung Ha 2 Hotel    |
| 22  | Visit to demonstration of tambaqui fish ( <i>Colossoma macropomum</i> ) and fish culture in a small dam in Hanh Phuoc commune of Nghia Hanh district   | Visit to fish culture system in An Khe swamp and in Liet Son reservoir, and Duc Pho fish seed hatchery in Duc Pho district | Hung Ha 2 Hotel    |
| 23  | Visit to Son Hai commune of Son Ha district to search for potential of small-scale fish culture  | Working at the hotel   | Hung Ha 2 Hotel    |
| 24  | Working at the hotel   | Working at the hotel   | Hung Ha 2 Hotel    |
| 25  | Working at the hotel   | Visit to the QN FSC office to learn about contribution of the center for aquaculture development                           | Hung Ha 2 Hotel    |
| 26  | Working at the hotel   | Visit to Nghia Tho commune of Tu Nghia district to search for potential of small-scale fish culture                        | Hung Ha 2 Hotel    |
| 27  | Working at the hotel   | - Visit to Duc Phong commune of Mo Duc district to search for potential rice-fish system trial                             | Hung Ha 2 Hotel    |
| 28  | Working at the hotel   | Working at the hotel   | Hung Ha 2 Hotel    |
| 29  | Working at the hotel   | Giving presentation to the PMU staff and the DoF   | Hung Ha 2 Hotel    |
| 30  | Working at the hotel   | Leave for Ho Chi Minh City   | Hung Ha 2 Hotel    |

### **Limitations**

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