

COMMISSION INTERNATIONALE DES GRANDS BARRAGES ----- LA 78 ^{EME} CONGRES DES GRANDS BARRAGES <i>Hanoi-Vietnam, may 2010</i>	
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A MONITORING METHOD OF MOUNTAIN HAWK EAGLE IN DAM CONSTRUCTION PERIOD*

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1. INTRODUCTION

Large dam construction projects to supply water and/or generate electricity are necessary for people to have a comfortable life. However, no matter how necessary those development projects are, the impacts on the environment must be considered and the projects justified in relation to environmental considerations. In Japan, Environmental Impact Assessment (EIA) is applied to large dam construction projects subject to the Environmental Impact Assessment Law enacted in 1997. Its objective is to consider mitigation measures reflecting the assessment result. The environmental factors subject to EIA are various, such as Air, Water, Flora and Fauna. Ecosystem is one of important environmental factors in EIA.

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To evaluate impacts caused by large dam construction projects to ecosystem, notable species are usually selected in terms of the upper species in the food chain. In Japan, the birds of prey, especially Mountain Hawk Eagle *Spizaetus nipalensis* (Hodgson, 1836), are often selected, since such projects are often executed in their habitats and people have a great interest in Mountain Hawk Eagle as an indicator species of natural forests. Mountain Hawk Eagle is listed as an endangered species in The Threatened Wildlife of Japan - Red Data Book compiled by the Ministry of the Environment in 2002.



Spizaetus nipalensis (Hodgson, 1836)

2. BIOLOGY OF MAUNTAIN HAWK EAGLE

Mountain Hawk Eagle inhabits mountainous areas throughout Japan as a resident species, and feed on various animals such as hares, copper pheasants and snakes. They don't prey on specific animals, prey on the animals that have a lot of numbers of individuals and can be caught easily. They hunt chiefly in the forest. Mountain Hawk Eagles begin mating displays at late autumn, the egg is laid in March, and fledglings leave the nests from the middle of July to the middle of August though there are a few differences depending on the region and the age (Table 1). An average ratio of the breeding success is about 30%.

Table 1
Life cycle of Mountain Hawk Eagle

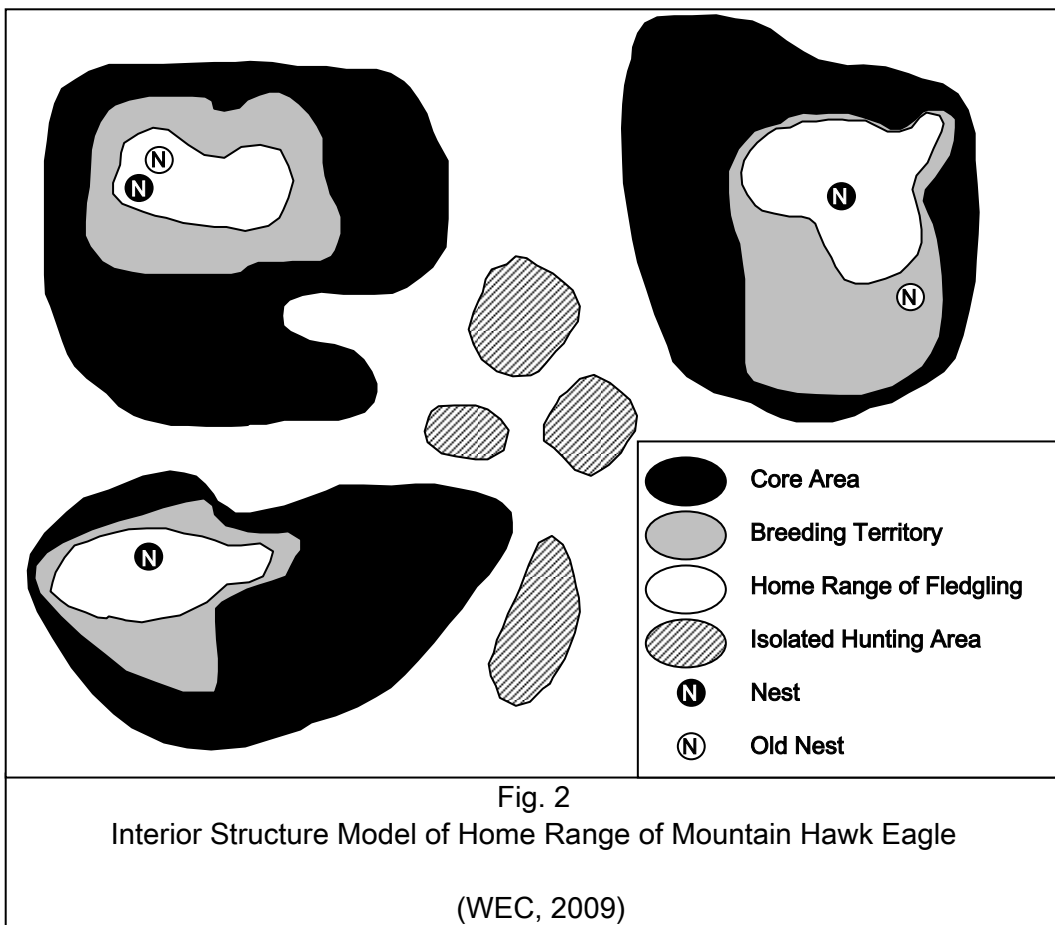
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan
Nest Making		Breeding		Raising in the Nest			Raising outside the Nest			courting		

(Modified from Ministry of the Environment, 1996)

Mountain Hawk Eagle's Biology Research Group (2000) defined the interior structure model of home range of Mountain Hawk Eagle as follows (Fig.1).

- Core Area : the area used relatively high rate; the annual life is based on this area,
- Breeding Territory : the area protected during breeding season,
- Home Range of Fledgling : the area used by the fledgling for a while after leaving the nest.

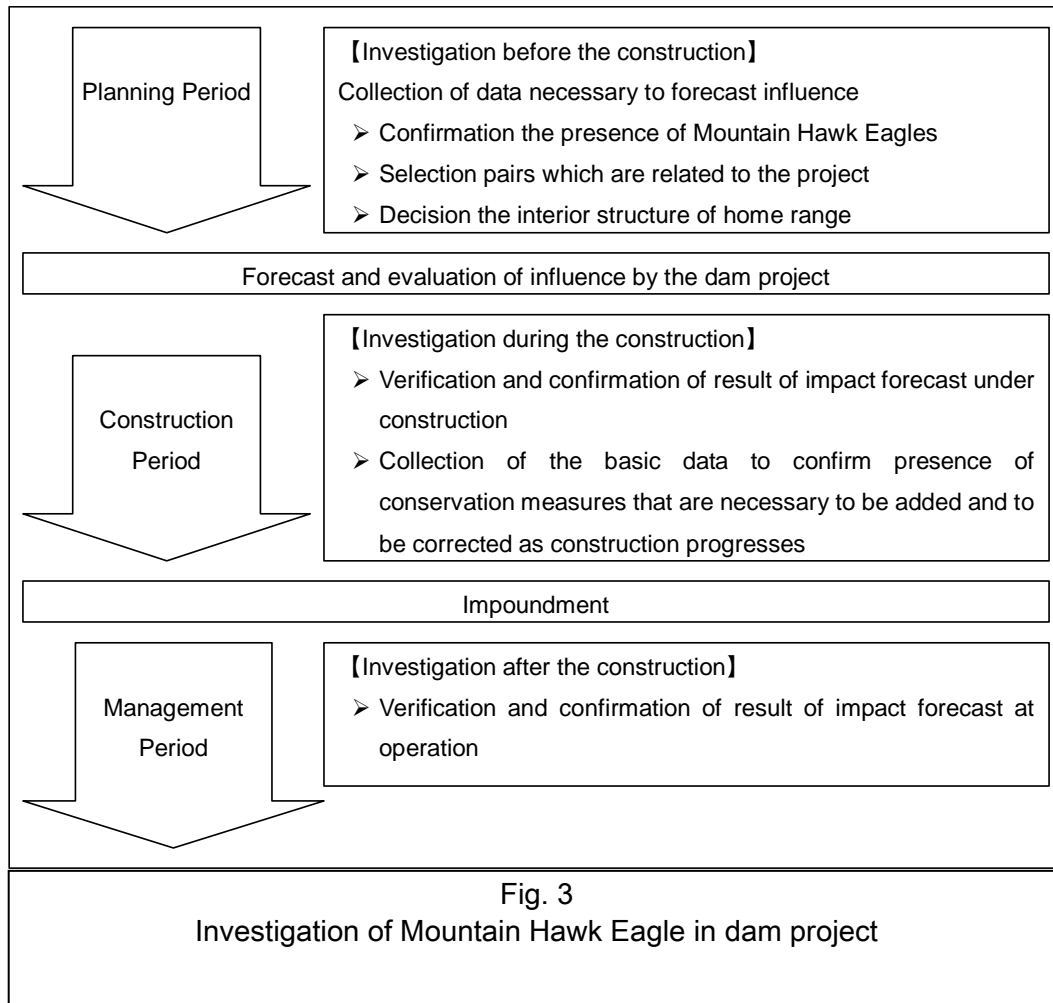
The possibility of the influence on the interior structure of home range and the breeding activity is forecasted by overlapping the interior structure and the construction areas or the modified areas.



3. INVESTIGATION OF MOUNTAIN HAWK EAGLE IN DAM PROJECT

In the dam project, a long term is needed from the planning to the completion of the dam. Because the investigation of Mountain Hawk Eagle is executed according to the progress of the dam project, the research objectives and the content are different according to the stage of the project. Investigation before the construction has aimed to collect of data necessary to forecast

influence of the dam project (Fig. 3). The investigation during the construction period has aimed to "Verification and confirmation of result of impact forecast under construction" and "Collection of the basic data to confirm presence of conservation measures that are necessary to be added and to be corrected as construction progresses". The investigation after the construction has aimed to "Verification and confirmation of the result of the impact forecast after the construction".



4. INVESTIGATION DURING THE CONSTRUCTION PERIOD

At the beginning of the investigation during the construction period, it is assumption that the forecast and the evaluation of the influence have ended. By collecting Mountain Hawk Eagle's data during the construction period, the prediction result will be verified and confirmed, and presence of conservation measures that are necessary to be added and to be corrected as construction progresses will be confirmed.

The factors that influence to Mountain Hawk Eagle under construction are the installation of substitution roads, construction roads, construction equipments, quarry sites, dam body, and management equipments, disposal sites of the surplus soil etc. The influence of construction is forecast from the viewpoint of noise, vibration, presence of people etc. by overlapping the interior structure of home range and the dam project area, measurement of the distance between the nest and the construction area, whether the construction area can be seen from the nest. The contents of influence are the change of the interior structure of home range and breeding activity. It is judged based on past cases. Conservation measures are executed when there is a possibility of the influence.

The relation to construction is different in each pair, and it is different according to progress construction. Therefore, the investigation content is different according to the targeted pair and the purpose of the investigation, such as to confirm the influence of each pair, to decide how to execute construction based on action data of the pair.

4.1. Content of the investigation

The investigation during the construction period is executed for the pair related to the project which core area includes the construction area or the reservoir area.

The content of investigation is selected according to the division of the pair such as "The influence of the construction is forecast" and "The influence of the construction is not forecast". The investigation is planned to every pair during one breeding season. Therefore, "The construction" here means the construction which will be executed during one breeding season. The division of the pair is as follows (Fig. 4),

- Pair to which influence is forecast; it is forecast that the change of interior structure of home range or breeding activity by the construction,
- Pair to which the construction schedule can be changed; temporary discontinuance of the construction or the change in the execution time can be executed as conservation measures,
- Pair to which the construction schedule can't be changed; temporary discontinuance of the construction and the change in the execution time can't be executed as conservation measures,
- Pair to which influence is not forecast; it is not forecast that the change of interior structure of home range and breeding activity by the construction, though the pair is included in the pairs related to the project.

Procedure for deciding the investigation content is shown Fig. 5, and contents of investigations are shown Table 2.

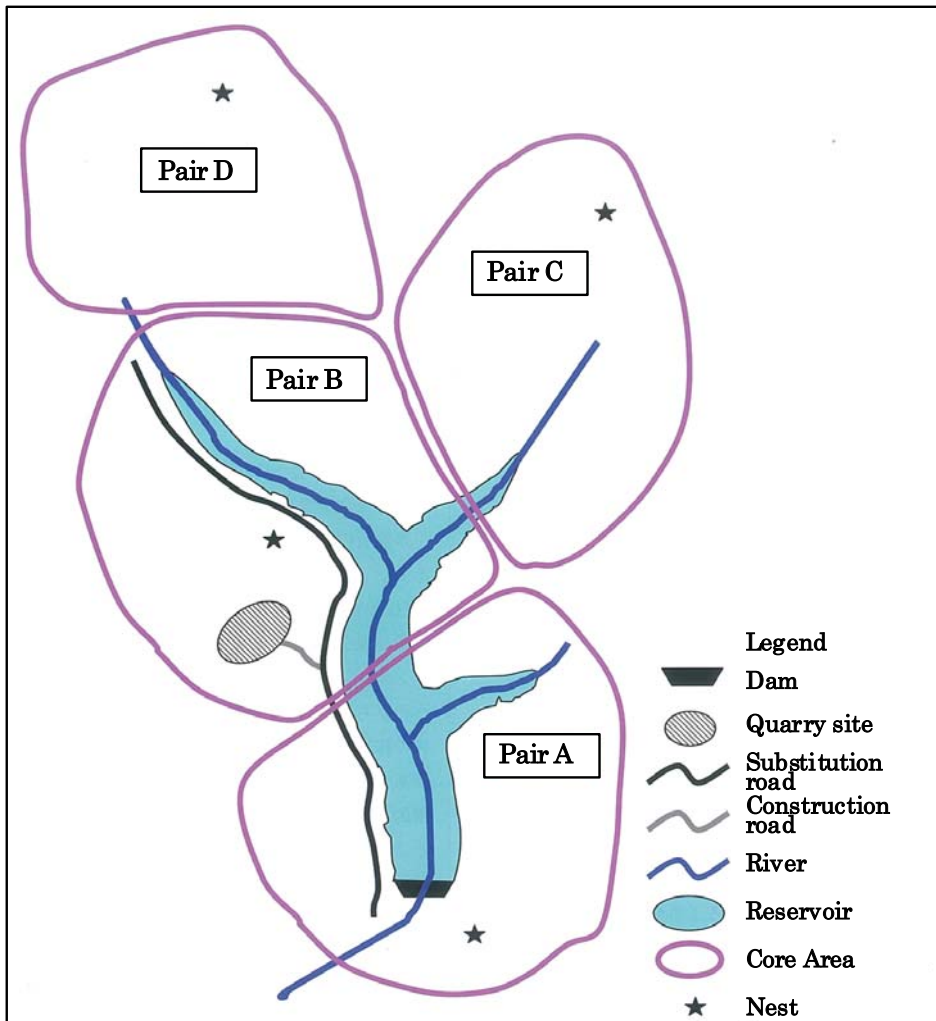


Fig. 4

Example of relation between home range of pairs and the dam project

- Pairs related to the project: A, B, C
- Pairs with influence of the project: A, B
- Pairs with no influence of the project: C
- Pairs not related to the project: D

4.1.1. *Pair to which the construction schedule can't be changed*

To understand presence and the level of the influence by the construction, "Investigation of the interior structure of home range" and "Investigation of breeding activity" are executed according to the level of the forecast influence.

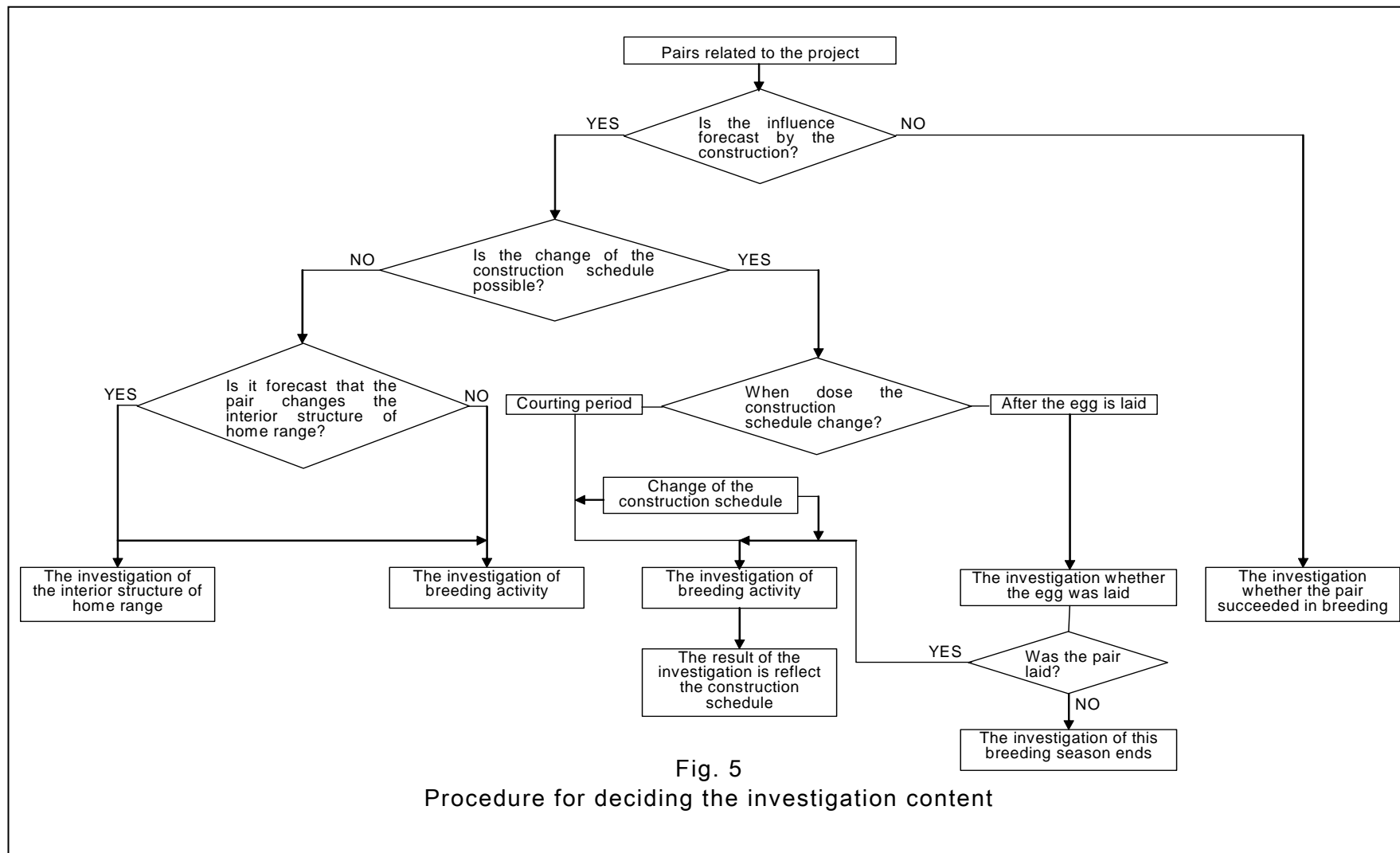


Fig. 5
 Procedure for deciding the investigation content

Table 2
Contents of the investigation during construction period

			The investigation of the interior structure of home range			The investigation of breeding activity	The investigation whether the egg was laid	The investigation whether the pair succeeded in breeding
			Change of core area	Change of breeding territory	Change of fledgling's home range			
Breeding season	Courting	Frecuency	One time or more	One time or more	-	-	-	-
		Object	Core eera Hunting area	Breeding territory Hunting area	-	-	-	-
	Making nest	Frecuency	One time or more	One time or more	-	One time or more	-	One time or more
		Object	Core eera Hunting area Nest	Breeding territory Hunting area Nest	-	Nest Breeding activity	-	Nest Breeding activity
		Frecuency	One time or more	One time or more	-	One time or more	Two times or more	-
	Breeding	Object	Core eera Hunting area Nest	Breeding territory Hunting area Nest	-	Nest Breeding activity	Egg	-
		Frecuency	One time or more	One time or more	-	One time or more	-	-
	Raising in the nest	Object	Core eera Hunting area Nest	Breeding territory Hunting area Nest	-	Nest Breeding activity	-	-
		Frecuency	One time or more	One time or more	Several times untill next February	Two times or more	-	Two times or more
	Raising outside the nest	Object	Core eera Hunting area	Breeding territory Hunting area	Position of fledgling	Breeding activity	-	Breeding activity
Frecuency		One time or more	One time or more	-	-	-	-	
Non-breeding season		Object	Core eera Hunting area	Breeding territory Hunting area	-	-	-	-

4.1.2. *Pair to which the construction schedule can be changed*

There are various cases in the change of the construction process. Here, the case to change the construction schedule from the courting period and the case to change the construction schedule after an egg had been laid are assumed.

In the case to change the construction schedule from the courting period, "Investigation of breeding activity" is executed. In this case, it is important to reflect the result of the investigation in the construction plan properly. For instance, in the case of temporal discontinuance of the construction works which is adopted as conservation measures, the construction can be restarted when the failure of breeding is confirmed.

In the case to change the construction schedule after an egg had been laid, "Investigation whether an egg was laid" is executed at first. If the egg was laid, "Investigation of breeding activity" is done after the execution of counter measure such as the change of the construction schedule. If the egg was not laid, the change of the construction schedule and further investigation are not needed. However, it is necessary to note whether an egg is laid again.

4.1.3. *Pair to which influence is not forecast*

To obtain basic data to judge the presence of the influence by the dam project, "Investigation whether the pair succeeded in breeding" is executed.

In Japan, Mountain Hawk Eagle can not succeed in breeding every year, and there is a tendency to breeding at the every other year in nature. Therefore, to judge the presence of the influence by the dam project, it is important to have been accumulating the data of the success or failure of breeding for a long term.

4.2. Note of investigation

4.2.1. *Setting of observation points*

In the investigation during the construction period, the chance to observe the nest and the surrounding increases to confirm the breeding situation. To reduce the influence of the investigation, setting the observation points near the nest should be avoided, especially it is necessary to avoid setting the observation point to the place where the investigator can observe in the nest. When the observation in the nest is needed by all means, the consideration which the investigator observes by using the blindfolding shade from the distance as much as possible is necessary.

4.2.2. *Days of investigation*

The basis of days of the investigation is three days or more per one time. However, if the egg or the fledgling was observed, or if the incubation behavior or the raising behavior was observed, the investigation can be ended in less than three days, during the breeding period or the raising period in the nest at "the investigation of breeding activity", "the investigation whether the egg was laid" and "the investigation whether the pair succeeded in breeding".

5. COUNTER MEASURES IN CONSTRUCTION PERIOD

For estimation of impacts to breeding caused by construction, the data of location of construction sites and breeding sites should be considered. The location data includes distance between construction sites and breeding sites, visible sight from breeding sites and so on. If construction works are afraid of influence breeding of the pairs, counter measures such as following will be taken.

- Temporal discontinuance of the construction works during breeding season when the construction works occurring near breeding sites
- Conditioning (to be accustomed to the construction works by gradually operation of construction machines or gradually enlargement of construction scale)
- Prohibition from the person related to the construction entering the surrounding area in the nest
- Use of low noise and low vibration machines
- Use of inconspicuous colors for machines and structures

6. ABOUT FURTHER STUDIES

The methods to analyze the breeding sites and hunting areas of Mountain Hawk Eagle have been devised. However, there are still several unknown factors about the degrees of impacts caused by dam construction projects that could influence breeding and hunting. Therefore, further studies are necessary to improve the accuracy of estimation of analysis. Beside of this, it should be noted that for preservation of Mountain Hawk Eagle, studies on impacts should be considered for not only individuals of Mountain Hawk Eagle, but for whole population existing around the project area.

REFERENCES

- [1] Ministry of the Environment, *Threatened Wildlife of Japan – Red Data Book 2nd ed. -, Volume 2, Aves*, 2002.
- [2] Mountain Hawk Eagle's Biology Research Group, *Mountain Hawk Eagle - Philosophy of Conservation and Control*, 2000.
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SUMMARY

The investigation topics, discussed in “Study Methods of Golden Eagle and Mountain Hawk Eagle for Dam Project” published by Water Resources Environment Technology Center in 2001, were designed to study literature on the raptors, distribution of home range and to analyze internal structure of home range at the stage of planning of construction. However, the monitoring methods in dam construction period have not been discussed. Up to now, investigations have been executed in some dam projects, and the level of the influence by construction has been understood to some degree. However, because the purpose of the investigation is different for the case to forecast the influence and under construction, the content of investigations is different. The investigation in a dam under construction has aimed to judge the presence of the influence of the dam construction to Mountain Hawk Eagle. Moreover, it has aimed to examine necessary conservation measures when the construction works influence to Mountain Hawk Eagle. The investigation during the construction period is executed for the pair related to the project which core area includes the construction area and the reservoir area. The content of investigation is selected according to the division of the pair such as "The influence of the construction is forecast" and "The influence of the construction is not forecast". The investigation is planned to every pair during one breeding season.