



# What is the appropriate time period for marine ecological surveys and monitoring?

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## Abstract

The reason why ecological distribution data should be collected over a long period of time is that long-term data is the only way to see whether the trend of ecosystem change is getting better or worse and the reasons for it, and to test whether the conservation policies or measures adopted by the government are effective or not. If the monitoring is done for the purpose of environmental impact assessment, the data before, during and after the development as well as the control group must be used for impact analysis (BACI) in order to understand whether the development will affect the surrounding environment. However, ecological surveys are costly in terms of manpower and material resources, especially in the case of marine ecological surveys. Therefore, the funding provided by the organizer is usually not long. Moreover, the governmental unit of the monitoring program has to go through open tendering, resulting in frequent turnover of the winning survey unit or the personnel responsible for the survey, which makes it impossible to maintain a consistent survey methodology and the quality of the surveys varies. In addition, the frequency of the survey, whether it should be conducted annually, quarterly or monthly, is also limited by the manpower, material resources and weather conditions of the survey, and the most cost-effective frequency or duration of the survey should be determined under the consideration of the permissible statistical sampling error.

How long does it take for an ecological survey to reflect changes in biodiversity? Three years, five years, ten years, thirty years, fifty years, what is considered medium term or long term? How many surveys should be conducted each year, etc. are often strategies that need to be thought out by the authorities in charge of nature conservation or environmental protection. Taiwan's EIA system is generally used for large-scale development projects, such as power plants, offshore wind farms, petrochemicals, sewage treatment plants, or science parks, which require year-round monitoring data from the pre-construction period to the end of operation, and even for several years after decommissioning. Therefore, it is usually possible to collect long-term data for 30-50 years. Other occasional pollution, natural disasters, or general research studies can only be conducted for 3-5 years. The lack of long-term monitoring data from fixed stations, even in protected areas designated by different ministries or decrees, often makes it impossible to answer the question of whether biodiversity has changed for the better or for the worse over the years since the establishment of the protected area.

In order to answer this question, we used the medium- and long-term data on fish assemblages in the intertidal and subtidal zones along the coast of Taiwan that we had on hand, including the surveys of deformed fishes, impingement, coral reef fishes, and drift-nets in the northern nuclear

power plant in the period of 20-40 years, the fishes collected in the tidal pools of the southern and northern parts of Taiwan in the period of 20-50 years, and the surveys of the cold intrusion event in Penghu in the period of 7 years, to make an analysis and a comparison. It was found that the trend of long-term ecological assemblages or ecosystem changes varied with the nature of the survey items or indicators (number of species, number of individuals, feeding habits or trophic level, thermoregulation) or sampling methods, the range of activities of the main target fishes, or their habitats (transients, semi-residents, or residents).