

WATER QUALITY AND FISH HABITAT ASSESSMENT OF RIVERS IN JOHOR
(SUNGAI DENGAR, SUNGAI TUI, AND SUNGAI MENKIBOL)

HERNI BINTI HALIM

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To:

My beloved Abah and Mak,

Halim bin Din and Shamsiah binti Kasim

My dear Angah and Ayin,

Hafiza binti Halim and Hazren binti Halim

My soulmate,

Mohamad Firdaus bin Mahamad Yusob

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ABSTRACT

Implementation of river rehabilitation programs are due to the apprehension expressed by local community and other stakeholders over the degradation of river and loss of livelihood from fishing and other natural resource-based activities. Usually, river rehabilitation involves works on water quality improvement and landscape enhancement rather than provides essential habitat for aquatic life especially fish. Consequently, this study is carried out in order to reveal the correlation between habitats and fish species towards improving the river rehabilitation efforts. Sungai Dengar near Gunung Belumut, Kluang, Sungai Tui in Bukit Kepong and Sungai Mengkibol in Kluang Town are three rivers that have been chosen for the purpose of the study as the rivers have different landuse and physical conditions. Sungai Dengar which is located in palm oil plantation and recorded as Class II of WQI, exhibits lowers composition of fish species compared to Sungai Tui. However it comprises two species which are not present in the other two rivers; Julong and Bujuk. Nevertheless, Sungai Tui, even though classified under Class III of WQI, exhibits a rich and diverse fish species composition with high economical value species such as Baung akar and Ketutu. Sungai Mengkibol of Class IV is dominated by hardy and tolerant species such as Bandaraya and Tilapia hitam. This study discovers that bankside vegetation, channel units, river size, migratory species and large woody debris are considered as the influential factors in shaping fish species community. The physical characteristics are important as they influence food availability, provide spawning or breeding ground, and protection from predators.

ABSTRAK

Perlaksanaan program pemuliharaan sungai selalunya dilakukan setelah penduduk setempat dan pihak yang bertanggungjawab menyuarakan kebimbangan terhadap pencemaran sungai dan kehilangan mata pencarian dari segi penangkapan ikan dan lain- lain kegiatan yang melibatkan sumber alam. Kebiasaannya, pemuliharaan sungai melibatkan kerja- kerja seperti peningkatan kualiti air dan pengindahan lanskap berbanding penyediaan habitat yang sesuai untuk hidupan air terutamanya ikan. Oleh sebab itu, kajian ini dilakukan untuk melihat hubungkait antara habitat dan spesies ikan ke arah memperbaiki usaha menjalankan program pemuliharaan sungai. Sungai Dengar yang terletak berhampiran Gunung Belumut, Kluang, Sungai Tui di Bukit Kepong dan Sungai Mengkibol di Bandar Kluang adalah tiga sungai yang dipilih dalam kajian ini kerana ketiga-tiga sungai tersebut mempunyai kegunaan tanah dan keadaan fizikal yang berbeza. Sungai Dengar yang terletak di dalam kawasan lading kelapa sawit dan mencatatkan Indeks Kualiti Air di Kelas II menunjukkan komposisi spesies ikan yang kurang berbanding Sungai Tui. Sungguhpun begitu, sungai tersebut mempunyai dua spesies ikan yang tidak terdapat di sungai- sungai lain dalam kajian ini; Julong and Bujuk. Walaupun Sungai Tui berada di Kelas III dalam Indeks Kualiti Air, mempunyai kekayaan and kepelbagaian spesies ikan yang mempunyai nilai ekonomi yang tinggi seperti Baung akar dan Ketutu. Sungai Mengkibol yang terdapat dalam Kelas IV didominasi oleh spesies ikan yang tahan lasak seperti Bandaraya dan Tilapia hitam. Kajian ini mendapati tumbuhan tepi tebing, unit-unit sungai, saiz sungai, spesies hijrah dan kayu-kayu dianggap sebagai faktor- faktor berpengaruh dalam membentuk komuniti spesies ikan. Ciri-ciri fizikal ini penting kerana menyumbang kepada ketersediaan makanan, menyediakan tempat bertelur atau membesar, dan tempat berlindung daripada pemangsa.

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CHAPTER 1

INTRODUCTION

1.1 Background of Study

Natural streams resources provide goods in form of fish, and other wildlife for harvest and enjoyment, as well as services such as regulation of hydrologic and nutrient cycles, and purification of water. In Malaysia, there are 1,800 rivers comprising 150 systems that run up to 38,000 km (Kalithasan Kailasam, 2007). As in many parts of the world, water from rivers and streams in Malaysia is used extensively for domestic needs, agriculture, aquaculture, industry and hydroelectric power as well as provide recreational use. Rivers are important as they support nation's economic development, social and cultural needs, religious beliefs and the natural environment. Clean water body and the riparian area in its vicinity support diverse and delicately balanced natural aquatic ecosystems.

Highly degraded ecosystems are not effective providers of goods and services, so this way, conservation and economics are inextricably linked. Disturbance to the stream ecosystem can result from floods, prolonged droughts, volcanic activity, wildfires as well as anthropogenic factors such as pollution, channel modification, flow

modification or direct interference to biota, such as clearing vegetation or introducing alien species. Landuse changes can have an impact on streams by affecting runoff rates and the input rates of sediment, woody debris and chemical pollutants. Well vegetated catchments with deep soils will absorb rainwater, releasing it slowly. If the vegetation is removed or change, as by clearing lands for farmland, logging, or by grazing, changes in stream hydrographs can occur. Clearing a large percentage of a catchment for urbanization, agriculture or timber harvest is generally thought to increase flood peak discharges and reduce their duration, and baseflow can also be altered (Gordon, N.D. *et al.*, 2004).

Channel modifications directly impact streams. The impacts can occur not only in the modified reach but also in upstream and downstream sections. Channelisation is typically carried out to improve drainage or flood carrying capacity, usually leaving a smooth, trapezoidal channel with improved conveyance and more predictable hydraulic behaviour. In extreme cases the riverbed may be reduced to a concrete channel or a buried conduit. In terms of habitat, channelisation reduces the structural diversity of streams through the reduction in meanders, smoothing of pools and riffles and irregular bank boundaries and removal of snags and riparian vegetation. This not only reduces the total amount of stream area and natural diversity of velocity and substrate patterns. Fish no longer have backwaters, pools or low-velocity regions for refuge during high flows, and fish eggs may be swept downstream by the higher velocities. Changes in hydraulics conditions selectively alter or reduce fish fauna, as increased velocities and shear stresses affect the hydrodynamics of body shape (Gordon, N.D. *et al.*, 2004). Riffles, which aerate the flow, are removed, shelter in the form of undercut banks and overhanging vegetation is eliminated, and the substrate is typically more unstable, reducing benthic invertebrate production

More attention is needed to rehabilitate river from time to time. It should be well cared and concerned of its importance as the aesthetic value of well managing river may increase the rate of country economic generation (Global Environment Centre, 2009). In

order to manage rivers and streams effectively, a necessary first step is to measure the availability and condition of the resources. Stream condition has traditionally been measured in terms of physico-chemical parameters, because this was appropriate to the emphasis on utilitarian use of the resource. Physico- characteristics are still important, but there has been a paradigm shift in the way stream condition is perceived and measured. Stream health now is measure in terms of water quality, habitat availability and suitability, energy sources, hydrology and the biota themselves. Stream classification operates at a different scale to stream health assessment, although measures of stream health can and often do form the basis of classification schemes. The main purpose of classification is to simplify the inherent complexity of streams systems. Classification is used as a communication tool that helps to facilitate many aspects of the management process, such a s taking an inventory of the resource, prioritizing issues or areas for management action, allowing stakeholders to make trade-offs, and documenting and demonstrating the effectiveness of management to the public (Gordon, N.D. *et al.*, 2004).

1.2 Statement of Problem

River rehabilitation has a tradition rooted in civil and hydraulic engineering where most of the work was grounded in well-established theory of stable channel design. Stream restoration activities are often focused on highly modified urban landscapes where the chances of achieving ecological restoration are extremely slim. This led to an emphasis on control of flow and structure using embankments, re-shaping channels to trapezoidal cross-sections, clearing snags and riparian vegetation, rock beaching of banks and construction of training structures. The inherently dynamic nature of rivers was seen as an annoyance that should be controlled, or if structures failed, as a catastrophic and unusual event. This conventional paradigm is now falling out of favour, where it is recognized that a level of channel instability is desirable from an ecological perspective, and that a high level of channel stability is difficult and

expensive to attain. Habitats are important in the fish life cycle requirements for food, shelter, reproduction, and movement. If the various life cycle requirements are not met due to loss of habitat, fish numbers drops, and eventually over time the entire population may even die out.

Man's activities have had profound, and usually negative, influences on freshwater fishes from the smallest streams to the largest rivers. Some negative effects are due to contaminants, while others are associated with changes in watershed hydrology, habitat modifications, and alteration of energy sources upon which the aquatic biota depends. Regrettably, past efforts to evaluate effects of man's activities on fishes have attempted to use water quality as a surrogate for more comprehensive biotic assessment. A more refined biotic assessment program is required for effective protection of freshwater fish resources.

1.3 Objectives of Study

The study concentrates on fieldwork of investigating the fish species composition and its habitat in running waters for the development of biological criteria for river rehabilitation. Therefore the objectives of the study are:

- i. To identify fish species in the river in terms of fish species composition and richness
- ii. To quantify physical features of aquatic habitat
- iii. To determine water quality of the river ; and

- iv. To establish the relationship between fish species composition, stream morphological condition and water quality condition.

1.4 Scope of Study

This study focuses on the description of the present ecological environment of three rivers with different level of disturbance or physical conditions: Sungai Mengkibul, in Kluang, Sungai Dengar, near Gunung Belumut National Park, and Sungai Tui, in Muar. Three main processes involve in this study are physical, biological, and chemical. They involve:

- i. Physical classification – general characteristic that are important in influencing river's aquatic ecology such as channel forms, instream habitats, substrates, bank vegetation and structure. Additional habitat attributes such as anthropogenic alterations to the river is briefly described.
- ii. Biological environment – the focus is on the composition and abundance of fish species
- iii. Chemical elements- documentation of the existing conditions related to commonly observed water quality parameters.

The study also involves in describing the correlation between the physical attributes with variation in the fish assemblages.

1.5 Limitations

There are a few environmental constraint identified that may interrupt with the process of collecting the essential data for this project. The constraints are listed as below:

1.5.1 Depth of Water Surface and Accessibility

Electro-fishing cannot be conducted if the water depth is higher than the waist level of the conductor, since the battery and cables for the electrode are carried with a backpack. The instruments shall not be immersed in water as this will caused short-circuits and thus endanger the conductor and the others in the river. Therefore, at certain sections, samplings cannot be conducted continuously along the gradient.

1.5.2 Topographical Condition

Health and safety is the main priority while performing the study, especially during the biological and habitat surveying. Physical conditions of river such as the slope of the banks, riverbed substrate, and surrounding vegetation that might pose hazards to the researchers (i.e. steep and slippery slopes, silt riverbed etc) were avoided. General and brief data could be obtained, however details of the morphological and biological features might be impaired.

1.5.3 Fish Collection Equipment (Gill Net)

Fish collection in deep water is conducted using gill net. The gill net is positioned across the river width as electro-fishing cannot be conducted in water depth higher than conductor waist. However, unexpected cases such as the lost of the gill net due to stolen activities in study area are far from prediction. Therefore, data of fish collection in deep water is difficult to be conducted. Fish collection equipment (gill net) turns out to be limitation factor in field work study.