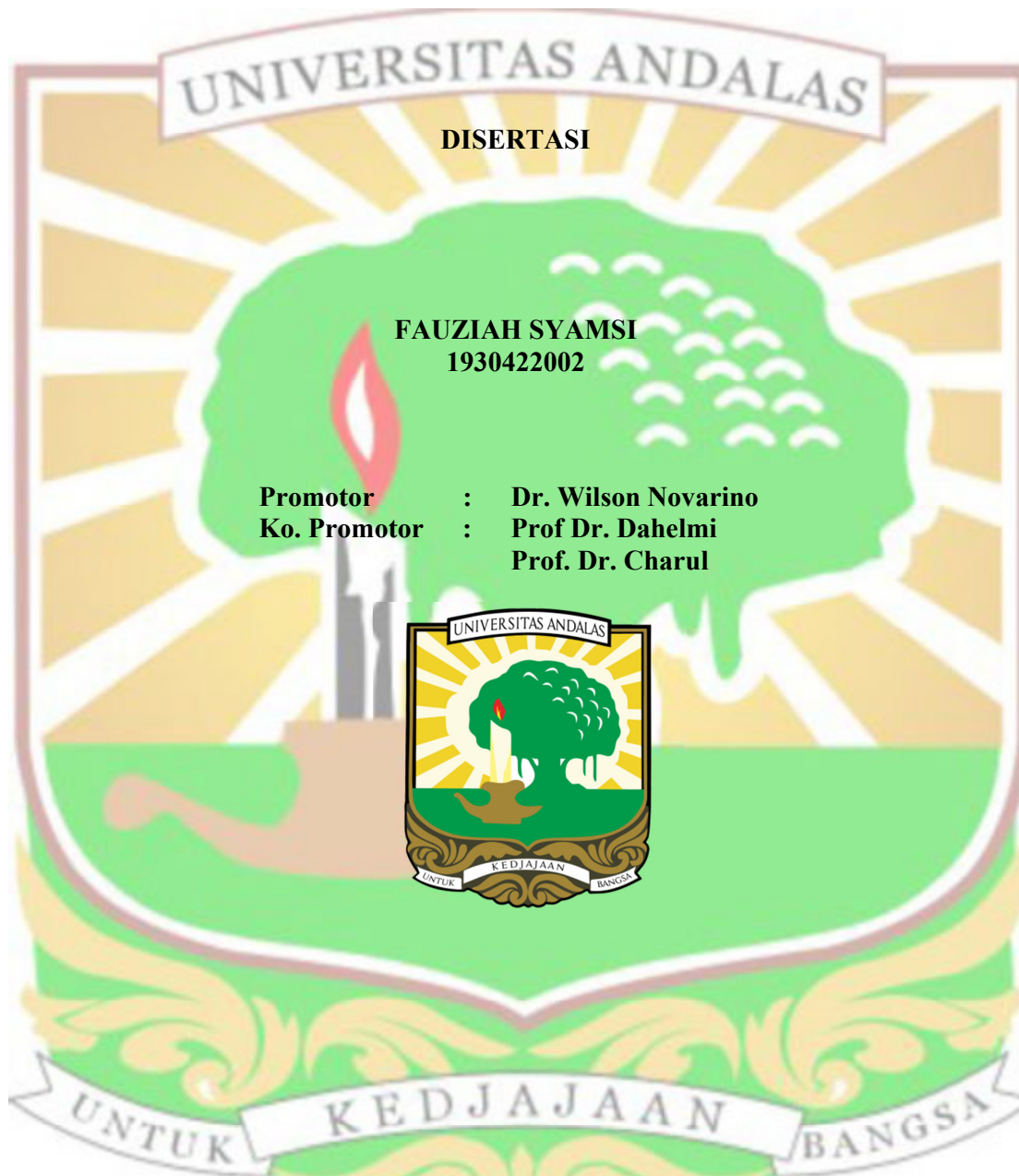


**EKOLOGI KELELAWAR (ORDO CHIROPTERA) PADA HUTAN
TERFRAGMENTASI DAN PULAU-PULAU KECIL DI KOTA BATAM**



**PROGRAM STUDI DOKTOR BIOLOGI
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RINGKASAN

Judul Penelitian ini adalah “**Ekologi Kelelawar (Ordo Chiroptera) pada Hutan Terfragmentasi dan Pulau-Pulau Kecil di Kota Batam**”. Penelitian ini disusun oleh Fauziah Syamsi, dan dibimbing oleh Dr. Wilson Novarino, Prof. Dr. Dahelmi, M.S., dan Prof. Dr. Chairul.

Kelelawar memiliki peran ekologi penting di ekosistem tropis, terutama di pulau-pulau, di mana mereka membantu menyebarkan benih, menyerbuki tanaman, mengontrol populasi serangga, dan menyediakan nutrisi bagi tumbuhan. Pulau adalah habitat penting bagi konservasi kelelawar karena kontribusinya terhadap kekayaan spesies secara keseluruhan. Namun, kelelawar di pulau menghadapi berbagai ancaman seperti modifikasi lanskap, perubahan iklim, hilangnya habitat, fragmentasi, perburuan, dan penyakit. Tekanan antropogenik dan pencemaran yang tinggi dapat mempengaruhi struktur komunitas dan gangguan kesehatan pada kelelawar, seperti sindrom *alopecia* dan gangguan kesehatan lain. Kondisi ini memerlukan perhatian khusus untuk mencegah kepunahan kelelawar pulau dan menjaga fungsi ekologisnya.

Penelitian ini dilakukan di Kota Batam yang terdiri dari Pulau Batam, Rempang dan Galang. Penelitian ini terdiri dari tiga tahap, yaitu pertama mengkaji tentang struktur komunitas kelelawar di Kota Batam. Tahap kedua mengkaji prevalensi ektoparasit dan kondisi tubuh kelelawar pada habitat alami di wilayah urban. Tahap ketiga mengkaji tentang model prediksi kesesuaian habitat kelelawar buah di Kota Batam.

Hasil penelitian tahap pertama, Sungai Ladi merupakan habitat paling stabil dengan keseimbangan terbaik dalam keanekaragaman spesies, sementara Duriangkang masih mendukung komunitas kelelawar meskipun mengalami tekanan ekosistem. Rempang dan Galang memiliki keanekaragaman rendah akibat keterbatasan sumber daya dan ukuran habitat yang kecil. Oleh karena itu, diperlukan upaya konservasi di Sungai Ladi dan Duriangkang serta pemulihan habitat di Rempang dan Galang untuk menjaga keanekaragaman hayati, khususnya kelelawar. Kekayaan spesies kelelawar cenderung lebih tinggi pada suhu 26–27°C, kelembaban 86–87%, dan kebisingan 46–47 dB. Analisis menunjukkan hubungan positif antara NDVI dan kekayaan spesies, menandakan bahwa vegetasi yang lebih rapat mendukung keanekaragaman. Selain itu, terdapat korelasi positif antara luas area dan jumlah spesies, dimana semakin luas habitat, semakin tinggi keanekaragaman spesies.

Hasil penelitian tahap 2, sebanyak 20,1% kelelawar di Kota Batam terinfestasi ektoparasit, dengan prevalensi tertinggi pada *E. spelaea*, *M. ater*, dan *M. muricola* (100%) akibat jumlah individu yang sedikit. Ditemukan 123 ektoparasit dari enam spesies. Tujuh jenis gangguan kesehatan juga teridentifikasi, terutama alopecia dan kerusakan sayap, serta abnormalitas seperti depigmentasi, cacat mata, dan benjolan, yang diperkirakan akibat tekanan lingkungan.

Hasil penelitian tahap tiga, model prediksi kesesuaian habitat kelelawar buah di Kota Batam menunjukkan performa tinggi (AUC 0,946–0,987). *B. maculata* memiliki kesesuaian habitat terbatas (16,23%), terutama di Pulau Batam, sementara *C. brachyotis*, *C. horsfieldii*, dan *C. sphinx* memiliki kesesuaian habitat yang lebih luas (43,42%–46,88%). Faktor utama yang mempengaruhi model kesesuaian habitat *B. maculata* adalah jarak dari garis pantai, NDVI, suhu, dan tutupan lahan, sedangkan ketiga spesies lainnya dipengaruhi oleh NDVI, kemiringan, sumber air, dan suhu.

Penelitian ini mengungkapkan bahwa komunitas kelelawar lebih beragam di hutan terfragmentasi dekat perkotaan dibandingkan pulau kecil dengan sumber daya terbatas. Prevalensi ektoparasit dan gangguan kesehatan mencerminkan tekanan lingkungan di

lanskap urban. Model prediksi habitat menunjukkan perbedaan faktor lingkungan yang mempengaruhi distribusi spesies kelelawar. Studi ini merekomendasikan perlindungan hutan, khususnya Hutan Lindung Sungai Ladi dan Duriangkang, serta pemulihan habitat yang terdegradasi untuk meningkatkan daya dukung lingkungan bagi kelelawar. Temuan ini dapat menjadi dasar bagi kebijakan perlindungan kawasan.

Kata kunci: Kumpulan kelelawar, pulau kecil, biodiversitas kota, ektoparasit, kondisi tubuh, kesesuaian habitat, analisis MaxEnt.



SUMMARY

The title of this research is “**Ecology of Bats (Order Chiroptera) in Fragmented Forests and Small Islands in Batam City**”. This research was prepared by Fauziah Syamsi, and supervised by Dr. Wilson Novarino, Prof. Dr. Dahelmi, M.S., and Prof. Dr. Chairul.

Bats play an important ecological role in tropical ecosystems, especially on the islands, where they help disperse seeds, act as pollinators, control insect populations, and provide plant nutrients. The islands are an essential habitat to bat conservation because of their contribution to the overall abundance of species. However, the island bats face many threats such as landscape modification, climate change, habitat loss, fragmentation, hunting and disease. High anthropogenic pressure and pollution can affect the structure of the community and cause health problems in bats, such as Alopecia syndrome and other health problems. These conditions require special attention to prevent the extinction of island bats and maintain their ecological functions.

This study was conducted in Batam City, which consists of Batam, Rempang, and Galang Islands. This research consists of three stages: the first is to study the community structure of bats in Batam City. The second stage is to study the prevalence of ectoparasites and the body condition of bats in natural habitats in urban areas. The third stage is the habitat suitability model of fruit bats in Batam City.

The results of the first phase of research, Sungai Ladi Protected Forest, is the most stable habitat, offering the best balance of species diversity. While Duriangkang still supports bat communities despite ecological pressures, Rempang and Galang exhibit low diversity due to limited resources and small habitat sizes. Conservation efforts should prioritize Sungai Ladi and Duriangkang to maintain biodiversity, while habitat restoration is essential in Rempang and Galang. Fragmented forests near urban areas with healthy vegetation and complex habitats provide better support for bat species than small islands with limited resources. Bat species richness tends to be higher at temperatures of 26–27°C, humidity levels of 86–87%, and noise levels of 46–47 dB. Analysis shows a positive relationship between NDVI and species richness, indicating that denser vegetation supports greater diversity. Additionally, there is a positive correlation between habitat size and species richness, where larger habitats support higher species diversity.

The results of the second phase of research, about 20.1% of bats in Batam City were infested with ectoparasites, with the highest prevalence in *E. spelaea*, *M. ater*, and *M. muricola* (100%) due to the low number of individuals. A total of 123 ectoparasites from six species were identified. Seven types of health disorders were also observed, primarily alopecia and wing damage, along with abnormalities such as depigmentation, eye deformities, and lumps, likely caused by environmental stress.

The results of the second phase of research, the predictive model for fruit bat habitat suitability in Batam City, exhibited high accuracy (AUC 0.946–0.987). *B. maculata* had a limited suitable habitat (16.23%), mainly on Batam Island, whereas *C. brachyotis*, *C. horsfieldii*, and *C. sphinx* had broader suitable ranges (43.42%–46.88%). Habitat suitability for *B. maculata* was primarily influenced by distance from coastline, NDMI, temperature, and land cover, while the other three species were affected by NDVI, slope, water availability, and temperature.

This study reveals that bat communities are more diverse in fragmented forests near urban areas than on small islands with limited resources. The prevalence of ectoparasites and health disorders reflects environmental stress in urban landscapes. The habitat prediction model highlights differences in ecological factors influencing bat species distribution. This study highlights the need for forest conservation, particularly in Sungai Ladi and

Duriangkang, and the restoration of degraded habitats to enhance environmental carrying capacity for bats. These findings can serve as a basis for conservation policy.

Keywords: Bat assemblage, small islands, urban biodiversity, ectoparasite, body condition, habitat suitability, maxent analysis.

