<table>
<thead>
<tr>
<th>Title</th>
<th>Species Composition and Diversity of Xanthoid Crabs (Decapoda: Xanthoidea) Among Dead Corals in Nhatrang Bay, South Central Vietnam</th>
</tr>
</thead>
<tbody>
<tr>
<td>Author(s)</td>
<td>HOC, DAO TAN; DU, PHAM THI</td>
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<td>Citation</td>
<td>Publications of the Seto Marine Biological Laboratory. Special Publication Series (2007), 8: 87-95</td>
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<td>2007</td>
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<td>Type</td>
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</table>

Kyoto University
Species Composition and Diversity of Xanthoid Crabs
(Decapoda: Xanthoidea)
Among Dead Corals in Nhatrang Bay, South Central Vietnam

HOC DAO TAN* and DU PHAM THI

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Abstract A total of 847 xanthoid crabs were obtained from 82 dead coral samples collected in
coral reefs of Nhatrang Bay during a biodiversity survey from 22 August to 22 September 2003.
Areas sampled included southern and northern Mun Island, Mieu Island, Bai Bang Island, Cau
Island and Tam Island. The material consisted of 72 species among 4 families and 32 genera.
Xanthidae was the most diverse and abundant family, representing 71% of all species and 92.1% of
all specimens, with Chlorodiella the most dominant taxon. While the two most dominant species,
Chlorodiella corallicola and C laevissima, made up only 3% of all species, they represented 54%
of the total number of individuals. The Shannon index of species diversity for xanthoid crabs
ranged from 2.29 to 4.21. Other indices confirm that Cau Island is the most favorable and the
northern site of Mun Island the least favorable in terms of overall xanthoid diversity. The similarity
of species composition among all coral reefs was about 40%. The xanthoid community structure of
reef-flats among different reefs was more similar than when comparing each reef-flat with the reef-
slope of the same coral reefs.

Key words: Xanthoid crabs, species composition, diversity, Nhatrang Bay, Vietnam

Introduction

Xanthoid crabs (superfamily Xanthoidea) are a group of Brachyura rich in genera and species
within the Indo-West Pacific (Serène, 1984). While found in various types of habitats, most xanthoid
crabs live subtidally among dead coral. Some of these crabs have been noted as indicators of coral reef
conditions (Abele and Patton, 1976; Austin et al., 1980). Xanthoids crab taxonomy and distribution
have been investigated in Vietnam since the mid 20th century (Dawydoﬀ, 1952; Serène and Bui Thi

Nhatrang Bay (12°08´-12°18´ N to 109°10´-109°24´ E) is located in the southern coast of Central
Vietnam and includes many islands and coral reefs. This area is excellent for studies on marine
diversity because it is relatively undisturbed and relatively rich in biodiversity. Given these
circumstances, the aims of this study were to provide information on the distribution and diversity of
xanthoids crabs among dead corals in the reefs of Nhatrang Bay, and to contribute to the literature of
faunal community structure of coral reefs. This study is a part of a project investigating the
biodiversity of Nhatrang Bay, Vietnam.

Materials and Methods

Xanthoid crabs were collected at six coral reefs in Nhatrang Bay in South Central Vietnam. The
location of the reefs is as follows (Fig. 1): 1, Cau Island (12°17´06´´N, 109°22´05´´E); 2, Bai Bang
(12°13´17´´N, 109°19´27´´E); 3, northern Mun Island (12°10´15´´N, 109°17´59´´E); 4, southern Mun
Island (12°10´02´´N, 109°17´47´´E); 5, Tam Island (12°10´18´´N, 109°13´30´´E); 6, Mieu Island
(12°10´58´´N, 109°14´00´´E). At each of the six study sites, two 100-meter-long transect tapes were
laid on the reefs parallel with the seashore, one on the reef plateau (shallow transect, from 1 - 5 m) and
the other on the reef slope (deep transect, from 5-12m). A diver used a 0.1m² benthic frame to collect samples along transects, at approximately 15m intervals; the collected layer of dead coral was about 5-10cm deep. On each transect, seven samples were collected, except from the deep transects on the northern and southern sites of Mun Island where only 6 samples were collected. In total 82 samples were collected. Crabs sorted out from collected samples were preserved in 75% alcohol. Xanthoid species were identified following Sakai (1976), Serène (1984) and Dai Ai-yun and Yang Si-liang (1991).

Sanders (1960) utilized a rating system to provide a “biological index” which was adopted for the present study. The index value of a species is determined by ranking the taxon from 1 to 10 based on relative abundance within each sample. The most abundant species is given a rank of 1 and a value of ten points; the species with rank 2, nine points; rank 3, eight points, etc. Thus a species ranked first in all 82 samples would have 820 points, the highest possible score. Relative dominance and commonality can be measured by examining the biological index and the frequency of occurrence for each species.

As a measure of biodiversity pattern, similarities in the species composition between study sites and sampling transects were estimated by the Bray-Curtis index. These study sites and sampling transects were clustered on the basis of the index. The species diversity was estimated using the Shannon and Wiener index (H’), species dominance by the Simpson index (C) and species evenness by the Pielou index (J’). Calculations of indices and cluster analysis were performed with PRIMER 5 (Primer-E Ltd.), while the statistic tests were done using Excel (Microsoft).

Results
Species composition
The material collected from coral reefs in Nhatrang Bay consisted of 847 specimens of xanthoid crabs identified from 82 dead coral samples. These taxa included 72 species among 32 genera and 4 families (Table 1). Among the four families found, the most abundant was Xanthidae with 780 individuals, representing over 90% of the total xanthoid abundance. The Xanthidae found included 51 species among 21 genera, representing circa 71% of all xanthoid species found. Conversely, only one carpiliid crab was found during the survey. Pilumnidae had 58 individuals including 16 species among 8 genera and there was 8 trapezid crabs including 4 species between 2 genera. On shallow transects xanthoid crabs were represented by 574 individuals, compared to 273 on deep transects. Xanthidae
### Table 1. Xanthoidea found among dead coral of Nhatrang Bay in August-September 2003.

<table>
<thead>
<tr>
<th>Family</th>
<th>Individuals</th>
<th>Transect</th>
<th>Genera</th>
<th>Species</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total</td>
<td>%</td>
<td>shallow</td>
<td>deep</td>
</tr>
<tr>
<td>Xanthidae</td>
<td>780</td>
<td>92.1</td>
<td>539</td>
<td>241</td>
</tr>
<tr>
<td>Pilumnidae</td>
<td>58</td>
<td>6.8</td>
<td>5</td>
<td>3</td>
</tr>
<tr>
<td>Trapezidae</td>
<td>8</td>
<td>0.9</td>
<td>29</td>
<td>29</td>
</tr>
<tr>
<td>Carpillidae</td>
<td>1</td>
<td>0.1</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>847</strong></td>
<td></td>
<td><strong>574</strong></td>
<td><strong>273</strong></td>
</tr>
</tbody>
</table>

### Table 2. Top ten abundance-ranked species of xanthoid crabs, based on biological index, found in dead coral at studied coral reefs.

<table>
<thead>
<tr>
<th>Species</th>
<th>Rank by biod. index</th>
<th>Biological index value</th>
<th>Frequency as one of ten most common species</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total</td>
<td>Bai Bang</td>
<td>Cau Island</td>
<td>Northern Mun Island</td>
</tr>
<tr>
<td><em>Chlorodiella coralicola</em></td>
<td>1</td>
<td>463</td>
<td>85</td>
<td>78</td>
</tr>
<tr>
<td><em>Chlorodiella laevissima</em></td>
<td>2</td>
<td>378</td>
<td>56</td>
<td>71</td>
</tr>
<tr>
<td><em>Psaumis cavipes</em></td>
<td>3</td>
<td>204</td>
<td>24</td>
<td>52</td>
</tr>
<tr>
<td><em>Eitisus ohdneri</em></td>
<td>4</td>
<td>172</td>
<td>50</td>
<td>41</td>
</tr>
<tr>
<td><em>Eitisus armatus</em></td>
<td>5</td>
<td>127</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><em>Chlorodiella nigra</em></td>
<td>6</td>
<td>79</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><em>Polidius sp.</em></td>
<td>7</td>
<td>77</td>
<td>10</td>
<td>17</td>
</tr>
<tr>
<td><em>Alcathoe setifer</em></td>
<td>8</td>
<td>71</td>
<td>43</td>
<td>0</td>
</tr>
<tr>
<td><em>Paramedus noelesis</em></td>
<td>9</td>
<td>67</td>
<td>27</td>
<td>40</td>
</tr>
<tr>
<td><em>Nanocassiope alcocki</em></td>
<td>10</td>
<td>63</td>
<td>9</td>
<td>21</td>
</tr>
</tbody>
</table>
was the most abundant family in both shallow and deep transects. There were 6 xanthoid species found, representing 1.3% of all individuals that are considered symbionts of living corals. They were the xanthids *Lybia leptochelis*, *Lybia tessellata*, and the trapeziids *Tetralia heterodactyla fusca*, *Trapezia cymodoce*, *Trapezia flavopunctata*, *Trapezia guttata* (see Appendix).

**Dominant species**

The biological index value and the frequency of a given species appearing as one of the 10 most abundant species are presented in Table 2. Among the top ten ranked species, *Chlorodiella coraliccola* and *Chlorodiella laevissima* dominate, each of these species being represented among the ten most common species in 50% or more of the samples. A separate analysis for deep (Table 3) and shallow

**Table 3.** Top ten abundance-ranked species of xanthoid crabs from deep transects.

<table>
<thead>
<tr>
<th>Species</th>
<th>Rank by bio. index</th>
<th>Biological index value</th>
<th>Frequency as one of ten most common species</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td><em>Chlorodiella coraliccola</em></td>
<td>1</td>
<td>171</td>
<td>13</td>
<td>3</td>
</tr>
<tr>
<td><em>Chlorodiella laevissima</em></td>
<td>2</td>
<td>155</td>
<td>7</td>
<td>6</td>
</tr>
<tr>
<td><em>Psamis cypipes</em></td>
<td>3</td>
<td>75</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td><em>Eititus ohdneri</em></td>
<td>4</td>
<td>74</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td><em>Paramedaeus noelensis</em></td>
<td>5</td>
<td>57</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td><em>Actinus setifer</em></td>
<td>6</td>
<td>54</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td><em>Eititus armatus</em></td>
<td>7</td>
<td>47</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td><em>Chlorodiella nigra</em></td>
<td>8</td>
<td>38</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td><em>Nanocestiope alcocki</em></td>
<td>9</td>
<td>32</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td><em>Heteropilumnus sp.</em></td>
<td>10</td>
<td>29</td>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>

**Table 4.** Top ten abundance-ranked species of xanthoid crabs from shallow transects.

<table>
<thead>
<tr>
<th>Species</th>
<th>Rank by bio. index</th>
<th>Biological index value</th>
<th>Times as one of ten most common species</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td><em>Chlorodiella coraliccola</em></td>
<td>1</td>
<td>292</td>
<td>21</td>
<td>4</td>
</tr>
<tr>
<td><em>Chlorodiella laevissima</em></td>
<td>2</td>
<td>223</td>
<td>9</td>
<td>9</td>
</tr>
<tr>
<td><em>Psamis cypipes</em></td>
<td>3</td>
<td>129</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td><em>Eititus ohdneri</em></td>
<td>4</td>
<td>98</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td><em>Eititus armatus</em></td>
<td>5</td>
<td>80</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td><em>Eititus goldeffroyi</em></td>
<td>6</td>
<td>52</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td><em>Pilodium sp.</em></td>
<td>7</td>
<td>50</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td><em>Chlorodiella nigra</em></td>
<td>8</td>
<td>41</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td><em>Nanocestiope alcocki</em></td>
<td>9</td>
<td>32</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td><em>Heteropilumnus sp.</em></td>
<td>10</td>
<td>29</td>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>
transects (Table 4) show similar results. Other species with high-ranking scores are *Psamnis cavipes* and *Etisus ohdneri* but fewer individuals were found and they did not rank high as often. A comparison of these four species along the shallow and deep transects shows that they are more abundant in shallow areas, the difference being especially pronounced for *C. corallicola* and *C. laevissima*. *Paramedaus noelensis* and *Actumnus setifer* were not among the top ten ranking taxa in shallow transects, nor were *Etisus goldeffroyi* and *Pilodius* sp. ranked highly in deep transects.

**Diversity analysis**

Table 5 lists the number of species (S), abundance, density (D), and species diversity (H'), species evenness (J'), and dominance (C) indices of xanthoid crabs living among dead coral of Nhatrang Bay study sites. While the southern site of Mun Island had the highest number of species, the species diversity index was highest in Cau Island, decreasing for Tam Island, Mieu Island, Bai Bang, southern Mun Island, and lowest at northern Mun Island with a value about half that of Cau Island. The species evenness values in Cau Island, Mieu Island, Tam Island and Bai Bang are similar (from 0.75 to 0.87) but considerably lower southern and northern sites of Mun Island (0.51 - 0.56). The species dominance index, on the other hand, indicates highest values for both Mun Island sites, but especially noticeable in the northern part of the island.

**Similarity of species composition between study sites and among sampling transects**

Using the Bray-Curtis similarity co-efficient on square root transformed abundance data; cluster analysis resulted in the study sites being classified into two groups at a similarity level of greater than 40% (Fig. 2). The first group includes the xanthoid groups of Mieu Island, Tam Island and northern Mun Island. Among that group, species compositions of the near shore sites of Mieu Island and Tam Island have the greatest similarity. The second cluster comprises the xanthoid groups of Cau Island, Bai Bang and southern Mun Island. Among these, the offshore sites of Cau Island and Bai Bang have the greatest similarity. Results show that there are two distinct groups of xanthoids representing nearshore (Mieu Island, Tam Island) and of offshore sites (Cau Island, Bai Bang), with southern and northern Mun Island sites representing an intermediate region.

The results of similarity indices of species composition in sampling transects (Fig. 3) are more complex. With the exception of Cau Island, where deep and shallow transects (1D, 1S), are similar, other study sites show a distinct difference between deep and shallow transects. For shallow transects, the community structure of xanthoid crabs of Mieu Island and northern Mun Island (6L, 3L), and southern Mun Island and Tam Island (4L, 5L) form a separate and distinct group with greater than 50% similarity. Among deep transects, northern Mun Island and Mieu Island (3D, 6D) and southern Mun Island and Bai Bang (4D, 2D) form distinct clusters at greater than 50% similarity. The results
indicate that in these coral reefs, the species composition of xanthoid crabs among flat parts of the reef, i.e. shallow transects, are more similar than flat and slope, or deep transects of the reef.

**Discussion**

The present study found 72 species among 32 genera and 4 families of xanthoid crabs in six coral reefs of Nhatrang Bay. This represents a disproportionate number when compared to the recorded 114 species among 40 genera of xanthoid crabs recorded for all of Vietnam (Nguyen et al., 1978). In Nhatrang Bay two species of Chlorodiella; *C. coralicola* and *C. laevissima* comprised more than half
of all collected specimens and thus represent the dominant taxa among dead coral. The relatively low abundance of species of Trapezia (*T. cymodoce*, *T. flavopunctata*, *T. guttata*), Tetralia (*T. heterodactyla fusca*) and Lybia (*L. leptochelis*, *L. tessellata*), which are considered to be symbionts of living corals, is likely due to are few living corals mixed in with the collected material.

The lower species dominance of xanthoid crabs in Cau Island, Mieu Island, Tam Island and Bai Bang (0.07-0.17), combined with higher diversity index values (3.09-4.24), indicate that conditions, such as habitat diversity, may be more favourable for xanthoid crabs in those locations. Conversely, low species diversity and evenness indices, and a relatively high species dominance index were observed at Mun Island, especially at the northern site. Conditions at this island thus are less favorable for xanthoids in general but quite tolerable for the two species of Chlorodiella, that were very abundant in both northern and southern sites of Mun Island and made up at least 70% of all individuals. The similarity at species level in the study sites was about 40% and there was difference between near shore sites (Mieu Island - Tam Island) and offshore sites (Cau Island - Bai Bang) from the intermediate region Mun Island. The xanthoid community structure of reef-flats among different reefs was a more similar to each other than when comparing each reef-flat with the reef-slope within the same coral reef. This indicates that environment and habitat, such as depth and coral reef morphology, are key components determining the distribution of these crabs.

**Acknowledgements**

This study was part of a biodiversity project with in the framework of the project titiled “coastal management and aquaculture” funded by the NUFU (The Norwegian Programme for Development, Research and Education). We thank all members of the Marine Living Resources Department, Nhatrang Institute of Oceanography, for their contribution in sampling work and for reviewing the early draft, and to Dr. Zdenek Duris for his valuable comments on the manuscript.

**References**


Appendix:
Species list of xanthoid crabs found among dead coral of Nhatrang Bay in August-September 2003.

<table>
<thead>
<tr>
<th>Family</th>
<th>Species</th>
<th>No. of ind.</th>
<th>Study sites</th>
<th>Transect</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Northern Mun Island</td>
<td>Bai Bang</td>
<td>Cau Island</td>
</tr>
<tr>
<td>Carpiliidae</td>
<td>Carpilius convexus</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Total Carpiliidae</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pilumnidae</td>
<td>Actunmus doripes</td>
<td>2</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Actunmus intermedius</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Actunmus setifer</td>
<td>11</td>
<td>7</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Actunmus squamosus</td>
<td>8</td>
<td>7</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Actunmus tomentosus</td>
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<td>1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Glabropilumnus sp.</td>
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<td>2</td>
</tr>
<tr>
<td></td>
<td>Globopilumnus globosus</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Heteropilumnus ciliatus</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Heteropilumnus sp.</td>
<td>3</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Parapilumnus corallophilus</td>
<td>3</td>
<td>3</td>
<td></td>
</tr>
<tr>
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<td>Parapilumnus sp.</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
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<td></td>
<td>Pilumnopoeus marginatus</td>
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<td>3</td>
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<td></td>
<td>Pilumnus minitus</td>
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<td>2</td>
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<td></td>
<td>Pilumnus sp.</td>
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<td>Planopilumnus labirintius</td>
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<tr>
<td>Total Pilumnidae</td>
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<tr>
<td>Trapezidae</td>
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<td>1</td>
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<tr>
<td></td>
<td>Trapezia cymodoce</td>
<td>1</td>
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<td></td>
</tr>
<tr>
<td></td>
<td>Trapezia flavopunctata</td>
<td>3</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Trapezia guttata</td>
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<td>2</td>
<td></td>
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<tr>
<td>Total Trapezidae</td>
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</tr>
<tr>
<td>Xant hidae</td>
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<td>1</td>
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<td></td>
<td>Actaea sp.</td>
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<td></td>
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<tr>
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<td>Actaeodes areolata</td>
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<td>1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Chlorodiella corallicola</td>
<td>278</td>
<td>91</td>
<td>25</td>
</tr>
<tr>
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