shellfisheries group at the North Carolina Division of Marine Fisheries provided useful advice, especially M. Marshall, F. Munden, D. Spitsbergen, and M. Street. M. S. Fonseca, G. W. Thayer, and two anonymous reviewers helped improve the manuscript. This study was sponsored by the University of North Carolina Institute of Marine Sciences and by the Office of Sea Grant, NOAA, U.S. Department of Commerce under grant No. NA81AA-D-00026, North Carolina Department of Administration.

Literature Cited

Brook, I. M.

Caddy, J. F.

Folk, R. L.

Glude, J. B., and W. S. Landers.

Ingram, R. L.

Medcof, J. C., and J. S. MacPhail.

Nelson, W. G.


Orth, R. J.

Peterson, C. H.

Santos, S. L., and J. L. Simon.

Stoner, A. W.

Sutherland, J. P., and R. H. Karlson.
1977. Development and stability of the fouling community at

HETEROCARPUS LONGIROSTRIS
MACGILCHRIST FROM
THE NORTHERN MARIANA ISLANDS

In March and April 1981 the National Marine Fisheries Service Honolulu Laboratory chartered the FV Typhoon to conduct a fisheries resource survey in the waters of the Commonwealth of the Northern Marianas Islands. One of the major objectives of this survey was the investigation of deepwater pandalid shrimp stocks. Although not previously recognized as a species of commercial interest (Holthuis 1980), Heterocarpus longirostris MacGillchrist 1905 was caught in sufficient numbers on this cruise to suggest a commercial potential.

Heterocarpus longirostris has been recorded in the literature from a few specimens caught in the Indian Ocean. MacGillchrist (1905) reported taking two male specimens at 1,754 m in the Bay of Bengal; Balss (1925), one female specimen taken at 1,143 m in the Maldive area. Catches from this cruise constitute a first record of this species from the Pacific Ocean. Heterocarpus longirostris is very similar to H. laevigatus in general morphology. Heterocarpus longirostris differs from H. laevigatus in that the preorbital surface of the rostrum is edentate and there is a blunt point posteriorly on the carina of the third abdominal somite. In H. laevigatus the dorsal surface of the rostrum is edentate in advance of the orbit and the posterior portion of the third abdominal somite is rounded. Further differences are discussed in MacGillchrist (1905).

The FV Typhoon fished for shrimp in the Saipan-Tinian area using traps baited with chopped fish, usually skipjack tuna, Katsuwonus pelamis. The traps consisted of half-round frames of iron rebar (91 X 72 X 42 cm) wrapped with 13 X 25 mm or 13 X 13

FISHERY BULLETIN: VOL. 81, NO. 2, 1983.
mm wire mesh and covered by either burlap or canvas over the arched upper surface. On each sampling day one string of three traps was set at each of three sampling depths, 366, 732, and 1,097 m (200, 400, and 600 fathoms). Strings were set in the afternoon and recovered the next morning with a normal soaking time of between 16 and 20 h. Three species of Heterocaropus—H. ensifer, H. laevigatus, and H. longirostris—accounted for the majority of the catch. Shrimp referable to both H. laevigatus and H. longirostris were present in the catches throughout the cruise, but during the major part of the cruise they were considered to be the same species and recorded as “H. laevigatus.” These two species were recorded separately only on the last two series of sets (two strings at each of the three experimental depths). Information on the catch for these six strings is presented in Table 1.

The species with the highest catch rate (kilograms per trap) was H. laevigatus; H. ensifer and H. longirostris followed with catch rates about half that of H. laevigatus. Heterocaropus laevigatus was also the largest species caught, averaging 25 individuals/kg. Heterocaropus longirostris was next, averaging 47/kg, and H. ensifer was the smallest, averaging 146/kg. Differences in the reproductive biology of these species are suggested by the differing proportion of egg-bearing females present in the catch for each species. The percentage of berried females was highest for H. ensifer at 33% whereas that for H. longirostris was only 19%, and no berried H. laevigatus were caught. It is quite likely that these values change on a seasonal basis. Vertical separation of the three species was complete for the last six strings set. Heterocaropus ensifer was caught only at 366 m, H. laevigatus only at 737 m, and H. longirostris only at 1,097 m.

Though not documented due to confusion in the species identification of H. laevigatus and H. longirostris during most of the cruise, there is reason to believe that species separation by depth was essentially complete for the entire cruise. Table 2 lists the catch of the three species of Heterocaropus for the entire cruise excluding the last six strings. Heterocaropus ensifer was found almost exclusively at 366 m with a few being caught at 732 m. Mean size and percentage of berried female values for the entire cruise (Table 2) are very similar to those obtained from the last six strings (Table 1) for H. ensifer (112/kg compared with 146/kg and 31% compared with 33%, respectively). Similarly, values of mean size and percent berried for H. laevigatus in Table 1 match closely those for the H. laevigatus/H. longirostris group at 732 m (and the few at 366 m) in Table 2 as do the values for H. longirostris (Table 1) with those at 1,097 m (Table 2). This supports the assumption of vertical separation of these three species.

Both H. laevigatus and H. ensifer are considered to be commercially important species and have supported small local fisheries in some Pacific areas (Hawaii State 1979). Based on the results of this cruise, H. longirostris compares favorably with these two species as one with commercial potential. It is very close to H. ensifer in relative abundance (mean catch in weight per trap) and second, to H. laevigatus, in mean size. Heterocaropus laevigatus is first in both

### Table 1

<table>
<thead>
<tr>
<th>Depth (m)</th>
<th>No. of traps fished</th>
<th>Species</th>
<th>Number</th>
<th>Weight (kg)</th>
<th>Catch</th>
<th>Mean catch/ trap (kg)</th>
<th>Mean size of shrimp (kg)</th>
<th>Percent berried</th>
</tr>
</thead>
<tbody>
<tr>
<td>366</td>
<td>6</td>
<td>H. ensifer</td>
<td>542</td>
<td>3.7</td>
<td>0.6</td>
<td>146</td>
<td>33</td>
<td></td>
</tr>
<tr>
<td>732</td>
<td>6</td>
<td>H. laevigatus</td>
<td>172</td>
<td>7.0</td>
<td>1.2</td>
<td>25</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>1,097</td>
<td>6</td>
<td>H. longirostris</td>
<td>170</td>
<td>3.6</td>
<td>0.6</td>
<td>47</td>
<td>19</td>
<td></td>
</tr>
</tbody>
</table>

### Table 2

<table>
<thead>
<tr>
<th>Depth (m)</th>
<th>No. of traps fished</th>
<th>Species</th>
<th>Number</th>
<th>Weight (kg)</th>
<th>Catch</th>
<th>Mean catch/ trap (kg)</th>
<th>Mean size of shrimp (kg)</th>
<th>Percent berried</th>
</tr>
</thead>
<tbody>
<tr>
<td>366</td>
<td>34</td>
<td>H. ensifer</td>
<td>1,580</td>
<td>14.05</td>
<td>0.4</td>
<td>112</td>
<td>31</td>
<td></td>
</tr>
<tr>
<td>366</td>
<td>34</td>
<td>H. laevigatus/H. longirostris</td>
<td>67</td>
<td>3.5</td>
<td>0.1</td>
<td>19</td>
<td>1.5</td>
<td></td>
</tr>
<tr>
<td>732</td>
<td>56</td>
<td>H. ensifer</td>
<td>36</td>
<td>0.3</td>
<td>0.01</td>
<td>117</td>
<td>17</td>
<td></td>
</tr>
<tr>
<td>732</td>
<td>56</td>
<td>H. laevigatus/H. longirostris</td>
<td>2,654</td>
<td>90.75</td>
<td>1.6</td>
<td>29</td>
<td>1.6</td>
<td></td>
</tr>
<tr>
<td>1,097</td>
<td>57</td>
<td>H. laevigatus/H. longirostris</td>
<td>1,920</td>
<td>35.9</td>
<td>0.6</td>
<td>53</td>
<td>21</td>
<td></td>
</tr>
</tbody>
</table>
categories. Although further survey work is needed to determine the depth of maximum abundance for *H. longirostris*, the apparent greater depth of habitat for this species (1,097 m as compared with 766 m for *H. laevigatus* and 366 m for *H. ensifer*) is the major undesirable characteristic for development of any proposed fishery. Fishing at these greater depths would require greater capital investment not only in a more powerful depth recorder but also in expensive line which would need to be replaced after any gear loss.

**Literature Cited**

BALSS, H.

CALMAN, W. T.

HAWAII STATE.

HOLTHUIS, L. B.

MACGILCHRIST, A. C.

ROBERT B. MOFFITT

Southwest Fisheries Center Honolulu Laboratory
National Marine Fisheries Service, NOAA
P.O. Box 3830
Honolulu, HI 96812

436