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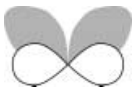

The zoogeography of algae-associated peracarids along the Pacific coast of Chile

Martin Thiel* *Facultad Ciencias del Mar, Universidad Católica del Norte, Coquimbo, Chile*

Abstract

Aim To describe the zoogeography of the algae-associated peracarid crustaceans from exposed rocky shores along the SE-Pacific.

Location Chile, 18° S to 42° S.

Methods A standardized sampling programme was used at all sites. Samples of macroalgae were taken at twenty sites distributed along the entire study area. Quantitative samples ($n = 6$ replicates of 8 cm^{-2} surface area each) of calcareous and non-calcareous red algae were taken in the low intertidal, preserved immediately in 4%-formalin and washed over a 0.2-mm mesh before sorting. All peracarid individuals were sorted, identified to the species level and then categorized in separate functional groups according to their feeding habits. Graphical representations of species replacement within each functional group along the latitudinal gradient are provided. A classification analysis employing the unweighted paired group method using arithmetic average (UPGMA) was conducted in order to reveal the main zoogeographical zones.

Results A total of forty epifaunal peracarid species was found. A gradual replacement of species within different functional groups (grazing and suspension-feeding species) was observed in the central region (*c.* 26° S–37° S). In this central region, species with northern and those with southern distribution overlapped, while other species were only found here, resulting in high species richness. The number of species/site/algal species in the northern (north of *c.* 25.5° S) and southern region (south of *c.* 38.5° S) was considerably lower than in the central region. The distribution of most grazing peracarids showed a more continuous pattern than that of suspension-feeding amphipods. The distribution of the remaining species (predators, scavengers, deposit-feeders, unknowns) was scattered along the examined sites. The cluster analysis for the epifaunal peracarid assemblage confirmed the separation of a northern and southern zone connected by a central (transitional) zone between *c.* 26° S and *c.* 37° S. Similar zonation patterns have been found by most other studies on the zoogeography of the Chilean coast, although little agreement exists about the exact limits of this transitional zone. It is discussed that the distribution limits of algae-associated peracarids (and other macroinvertebrates) – particularly in the transitional zone – may show interannual variations as a result of varying oceanographic conditions. The large affinity of the algae-associated peracarid fauna from the central and southern Chilean coast to those of other regions indicates that dispersal may be facilitated by rafting with floating algae transported in the Antarctic Circumpolar Current.

Main conclusions The zoogeographical analysis of algae-associated peracarids confirms the existence of a northern and a southern zone connected by an extensive transitional zone. General biology, habitat use and the abundant presence of dispersal vectors such as floating macroalgae may affect the zoogeography of species living in transitional zones with strong interannual variations in current regimes. In these areas, species associated with substrata of high dispersal potential may show different distribution patterns than species inhabiting other substrata.

*Correspondence: Facultad Ciencias del Mar, Universidad Católica del Norte, Larrondo 1281, Coquimbo, Chile. E-mail:thiel@ucn.cl

Keywords
Biogeography, peracarida, epifauna, macroalgae, exposed shore, intertidal zone.

Resumen

En el presente se estudió la zoogeografía de crustáceos peracáridos asociados a algas a lo largo de la costa rocosa expuesta del Pacifico-SE (Chile, 18°S a 42°S). Se realizó un programa de muestreo estandarizado, recolectándose macroalgas en 20 sitios distribuidos a lo largo del área de estudio. Se encontró un total de 40 especies de peracaridos epifaunales, perteneciendo principalmente a los grupos funcionales de ramoneadores y de suspensivoros. En la zona central ($\sim$ 26° S a $\sim$ 37° S) se observó un reemplazo gradual de especies para cada uno de los grupos funcionales estudiados. En esta región transicional, especies de distribución norte y sur pueden ser encontradas. En adición, varias otras especies de peracáridos fueron recolectadas únicamente en esta región, lo que resulta en una alta riqueza de especies para esta zona. El número de especies sitio^{-1} tipo de alga^{-1} en la región norte (al norte de $\sim$ 25.5° S) y en la región sur (al sur de $\sim$ 38.5° S) fue considerablemente menor que el observado en la región central. La distribución de la mayoría de los peracáridos con un hábito ramoneador mostró un patrón mas uniforme que el de los anfípodos suspensivoros. La distribución de especies pertenecientes al resto de los grupos funcionales (depredadores, carroñeros, depositivoros, habito desconocido) fue dispersa a lo largo de los sitios examinados. El análisis zoogeográfico de peracáridos asociados a algas confirma la existencia de una zona norte y otra sur conectadas por una extensa zona transicional. La biología general, el uso del hábitat y la presencia común de vectores de dispersión tales como macroalgas flotantes podrían afectar la zoogeografía de aquellas especies que habitan en zonas de transición con fuertes variaciones interanuales en el régimen de corrientes. En estas áreas, especies asociadas con substratos que presenten un alto potencial de dispersión podrían mostrar un patrón de distribución diferente al mostrado por especies que habitan otros tipos de substratos.

Palabras claves
Biogeografía, Peracarida, Epifauna, Macroalga, costa expuesta, zona intermareal.

INTRODUCTION

The zoogeography along the Chilean coast is characterized by a northern fauna that is separated from the southern fauna by a transitional zone in which species with northern and southern origin overlap (for most recent review see Lancellotti & Vásquez, 1999, 2000). Most previous studies have noted the existence of this transitional zone, but the limits of this zone vary substantially between the different studies. Based primarily on the results from the 'Lund University Chile Expedition 1948–49' Brattström & Johanssen (1983) placed it between 30° S and 41° S, while Lancellotti & Vásquez (1999), based on more recent and complete information, revealed a transitional zone between 35° S and 48° S. The data used for both these reviews of the zoogeography of the Chilean coast consist primarily of species reports taken from a variety of different studies. The sampling intensity and frequency in many of the original studies varies considerably, which may introduce some uncertainty to the zoogeographical analyses. Furthermore, the original data for most previous analyses have been provided by many different contributors, who may themselves have compiled a wide variety of different literature resources for their studies. For example, Gonzalez (1991) reviewed 115 references for his catalogue of the amphipod species from Chile. He pointed out that some of the amphipod taxa found along the Chilean coasts are in urgent need of revision, thus hinting that some records could be erroneous. Despite these apparent shortcomings, it must be acknowledged that the meta-analysis conducted by Lancellotti & Vásquez (1999, 2000) has revealed relatively clear patterns. In light of increasing concern for marine conservation issues, the latter authors expressed their hope that their results may serve to generate future studies that may help to refine our understanding of zoogeographical patterns (see also Fernandez *et al*., 2000).

The objective of the present study was to introduce a different approach to zoogeographical studies along the Chilean coast. Instead of qualitative sampling methods as have been used in most previous studies (see, e.g. Brattström & Johanssen, 1983), I employed a quantitative sampling approach. At each site, I took the same number of replicate samples of the same surface area. This method has the advantage that search effort is the same at all sites. Biases introduced by the fact that some sites are searched more intensively than others will thereby be minimized. This issue has for a long time been of concern to Chilean researchers because the central region, which harbours most universities and taxonomic experts, has been investigated more intensively than other regions, possibly resulting in the much higher numbers of species reported from this region (Lancellotti & Vásquez, 2000). Furthermore, all species found in the present study have been identified by the same person. While this does not preclude the possibility of accidental misidentifications, these errors would be the same for all sites. For example, a species misidentified at site B would be equally misidentified at site E. However, the possibility to commit errors of the following kind is substantially reduced: one species identified from site B by one worker could accidentally be taken for another species at site E by another worker. Alternatively, two different species from two sites might be taken for the same species by different workers. Mistakes of this type frequently occur in cases where different workers are involved with the identification of species (see, e.g. Poore, 1996). Additionally, in the present study sampling efforts were limited to a well-defined habitat (intertidal turf algae) thereby avoiding problems caused by pooling data from diverse habitat types. These turf algae harbour a distinct assemblage of peracarid functional groups (Buschmann, 1990). At many sites, a given functional group was only represented by one or two species. Should zoogeographical borders exist within the spatial range of the present study, a replacement of species should be expected primarily within these functional groups.

MATERIALS AND METHODS

Study area

The study was conducted over a geographical range of *c.* 24 latitudes along the exposed rocky coast of Chile. Samples were taken at twenty sites from Arica in the north of Chile (18°30′ S, 70°20′ W) to Cucao in the southern part of Chile (42°35′ S, 74°10′ W). The area covered by the present study does not reach as far south as that treated recently in Lancellotti & Vásquez (2000), but some of the present sites are located within the southern zone identified by most previous authors (e.g. Brattström & Johanssen, 1983).

The study area is strongly influenced by the Humboldt Current coming from the South and transporting cold waters towards the north (see overviews in Brattström & Johanssen, 1983; Arntz & Fahrbach, 1991). Interannual variations in oceanographic conditions occur in the study area, which is strongly affected by the El Niño Southern Oscillation ENSO-phenomenon. During some years large scale variations in the climate-oceanographic system of the Pacific cause strong extensions of warm waters towards southern latitudes accompanied by a weakening of the Humboldt Current (El Niño), resulting in considerably warmer water temperatures at sites as far south as 37° S (Arntz & Fahrbach, 1991).

Sampling of algae

All sites sampled herein were located at fully exposed shores along the Pacific coast of Chile. Peracarids were collected in calcareous (*Corallina officinalis*) and non-calcareous red algae (*Gelidium chilense*, *G. lingulatum*, *Polysiphonia* spp.). All algal samples were taken in the low intertidal zone during low tide. A sampling jar with an opening area of 8 cm^2 was placed over an algal patch and all algae together with all epifauna were scraped into the jar. Six replicate samples of the respective algal species were taken at each site, and immediately preserved in 4% formalin. Upon return to the laboratory, the samples were washed over a sieve with 0.2 mm mesh size, all peracarids were sorted from the algae and identified to the lowest taxonomic level possible. The peracarid species found herein were categorized in different functional groups according to their main feeding habits.

Data analysis

The distribution pattern of individual species within each functional group of peracarids was presented as distribution maps. For the biogeographical analysis of the entire algae-associated peracarid assemblage, presence/absence data from the sites at which calcareous ($n = 16$) and non-calcareous ($n = 15$) algae had been sampled were selected. Two separate analyses were conducted for peracarids from calcareous and non-calcareous algae, respectively. All species that occurred at more than one site and that could be identified at least to the genus level were included in the data matrix (twenty-nine species from calcareous and twenty species from non-calcareous algae). All stations within the distribution limits of a particular species were assumed to be within the distribution range of the respective species. The resulting data matrix was analysed with the unweighted paired group method using arithmetic averages (UPGMA) (Sneath & Sokal, 1973).

RESULTS

A total of forty peracarid species were collected between Arica (18° S) and Chiloé (43° S). Between four and sixteen peracarid species/site were found both in calcareous as well as in non-calcareous red algae (Fig. 1). The highest numbers of species (>10 species/site/algal species) were found at the sites of the central Chilean coast between Taltal (*c.* 25.5° S) and Tirua (*c.* 38° S). With the exception of Pumillahue-N (*c.* 42° S), where thirteen peracarid species were found in calcareous red algae, at all the sites north of *c.* 25.5° S and

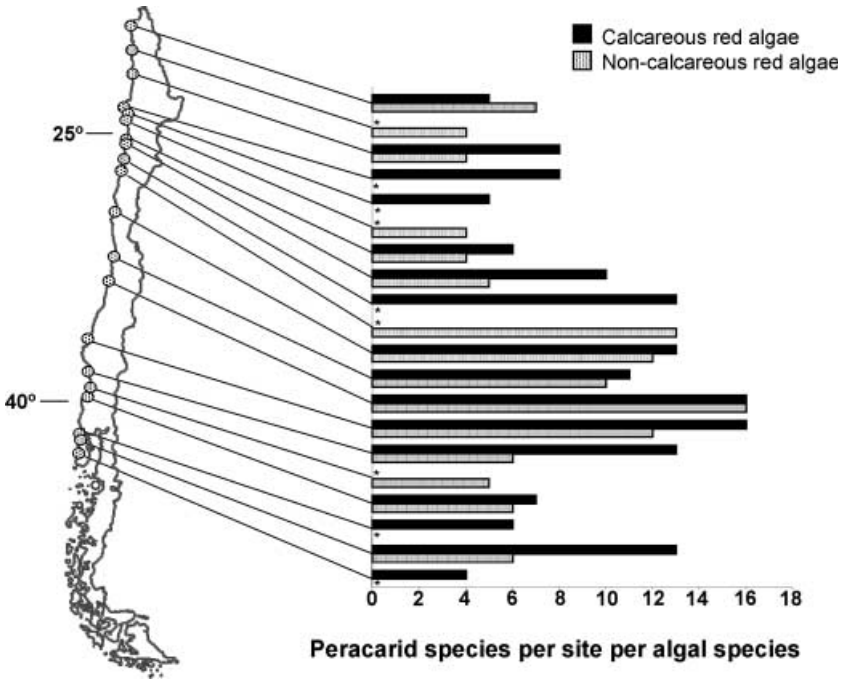

Figure 1 Total number of peracarid species/algal species in calcareous and non-calcareous red algae at each of the twenty sampling sites along the Chilean coast during the southern summer (January/February 1999); for each type of alga and each sampling site $n = 6$ replicates of 8 cm^2 surface area were taken; *indicates sites at which only one type of red algae was sampled.

south of *c.* 38° S no more than eight peracarid species/site/algal species were found (Fig. 1).

In the central region between Chañaral (*c.* 26° S) and Concepción (*c.* 37° S), northern species overlapped with southern species (Figs 2 and 3). This gradual replacement of species becomes evident in the functional group of mobile grazing amphipods where, e.g. the northern species *Hyale rubra* var. B and the southern species *H. hirtipalma* overlapped in their distribution between Caldera (*c.* 27° S) and Valparaíso (*c.* 33° S). In the region between Coquimbo (30° S) and Concepción (*c.* 37° S), up to four species/site/algal species were found in this group of mobile grazing amphipods whereas at the sites north or south of these locations never more than two species/site/algal species were found (Fig. 2). A similar situation was found for small grazing isopods (Asellota) where the overlap between northern and southern species primarily occurred in the region between Taltal (25.5° S) and Concepción (*c.* 37° S) (Fig. 2). In this group, one species (*Ianiropsis tridens*) was exclusively limited to the northern region and was not found south of Juan Lopez (*c.* 23° S). Among the small grazing isopods are also species that were exclusively found in the central region (e.g. *Neojaera elongatus*, *Santia* sp. A). Relatively little species overlap was found in the group of the large grazing isopods (Sphaeromatidae) (Fig. 2). The northern species *Paradella bakeri* extended as far south as Taltal (*c.* 25.5° S) and then disappeared being replaced at one site farther south by *Ischyromene menziesi* (in Chañaral at *c.* 26° S). One other sphaeromatid isopod species (*Cymodocella foveolata*) was only found in the central region between Valparaíso (*c.* 33° S) and Tirua (*c.* 38.5° S). Interesting is the case of *Ischyromene tuberculata* that was found at several southern stations (south of 40° S) and with three individuals in one sample in Taltal (*c.* 25.5° S). Thus, this species had a very disjunct distribution not being represented in samples from a coastal stretch extending over 15 latitudes (> 2000 km). No other species found in the present study had such a large gap over its distribution range.

The distribution of suspension-feeding peracarids is much more discontinuous than that of grazing peracarids (Fig. 3). Many of the suspension-feeding amphipods only occurred at a few sampling sites often with gaps that could extend over several latitudes. While in the northern and southern regions not more than four different species were registered, in the central region a diverse assemblage of nine different suspension-feeding amphipods was found. The suspension-feeding tanaids have a very wide distribution in the study area, ranging for the two most abundant species from *c.* 42° S to *c.* 22° S and *c.* 18° S, respectively, thus extending over *c.* 20 latitudes.

Many of the remaining species occurred scattered throughout the study area. Only *Paramoera fissicauda* has a relatively continuous distribution between Pumillahue (*c.* 42° S) and Pichilemu (*c.* 34.5° S). Most of the other species only occurred at some sites of the Chilean coast (Fig. 3). Because of their relatively low abundances in the samples, they may not have been sampled representatively, and their actual distribution range may be wider than revealed in the present study.

The cluster analyses for the epifaunal peracarid assemblage from calcareous and non-calcareous red algae confirmed a subdivision in three zoogeographical regions (Fig. 4). The northern region includes all sampling sites up to Taltal-S (*c.* 25.5° S), the central region extended between Chañaral (*c.* 26° S) and Concepción (*c.* 37° S), and the southern region included Tirua (*c.* 38.5° S) and the sites south thereof. There is a relatively strong break between the

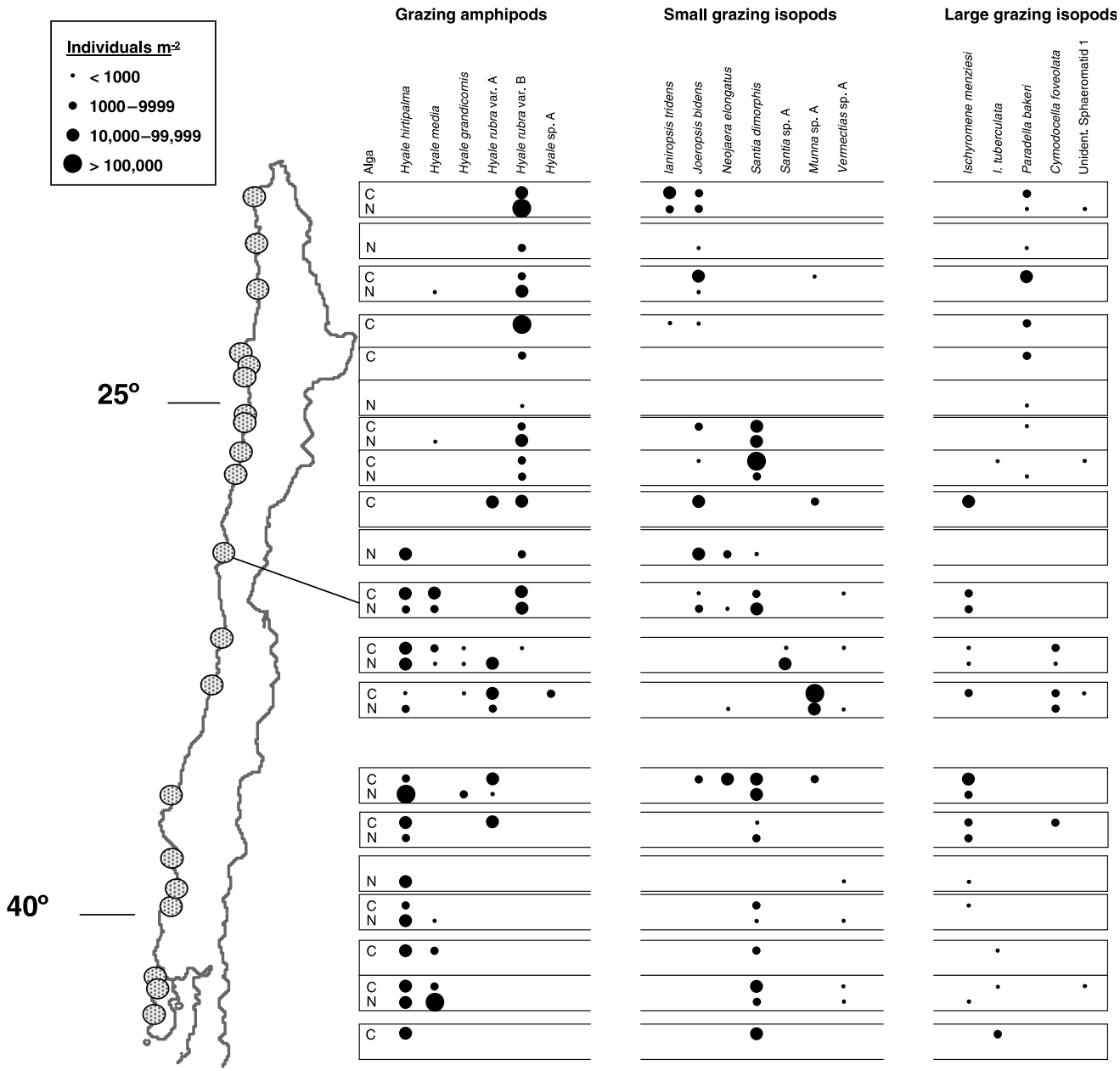

Figure 2 Presence of grazing peracarid species in calcareous (C) and non-calcareous red algae (N) at each of the twenty sampling sites along the Chilean coast during the southern summer (January/February 1999); for each type of alga and each sampling site $n = 6$ replicates of 8 cm^2 surface area were taken.

northern and the central region, while the differences between the central and southern region are weak (Fig. 4).

DISCUSSION

The results of the present study revealed three zoogeographical zones along the Chilean coast. Within the functional groups of epifaunal peracarids, a gradual replacement of species occurred in a transitional zone (from *c.* 26° S to 37° S), in which northern and southern species may overlap. Additionally, some species only occurred in this transitional zone. Consequently, the number of species/site was highest in this zone, which includes the central Chilean coast. The fact that a distinct zoogeographical zonation pattern was revealed in the present study could be surprising given that the analyses were based on a comparatively small number of peracarid species compared with other studies from this area, which included hundreds of species from many

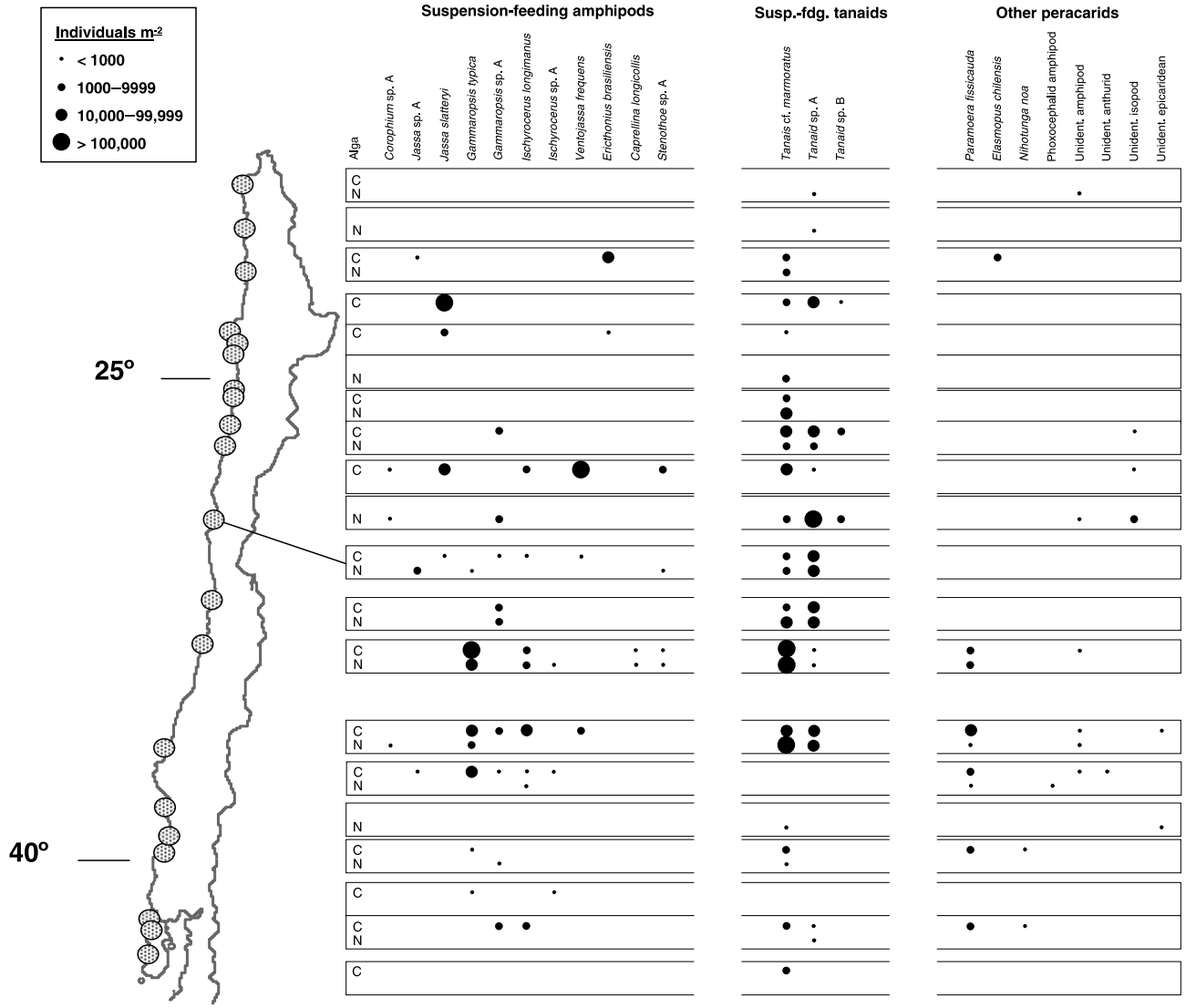

Figure 3 Presence of suspension-feeding amphipod and tanaid species and of other peracarid species in calcareous (C) and non-calcareous red algae (N) at each of the twenty sampling sites along the Chilean coast during the southern summer (January/February 1999); for each type of alga and each sampling site $n = 6$ replicates of 8 cm^2 surface area were taken.

different taxa (Lancellotti & Vásquez, 2000). However, the present results indicate that the approach used herein is useful to help understanding the zoogeographical patterns found along the Chilean coast. Zoogeographical studies focusing on single taxa (here: peracarids) may be particularly instructive, as they permit to a larger extent than multi-taxa studies the consideration of the biology of species in order to explain the observed patterns.

High species richness in the central zone of the continental Chilean coast

Variable intensities of search efforts may distort the results of both small-scale and large-scale studies. Scientists studying the zoogeography of the marine fauna from Chile have for a long time been aware of these problems (Brattström & Johanssen, 1983; Lancellotti & Vásquez, 2000). They suspected that the high number of species found along the central coast of Chile (between about 30° S and 38° S) is partly because of the fact that this region received comparatively high research attention. In the present study, the search effort was the same at all twenty sites. Nevertheless, high species richness of algae-associated peracarids was revealed for many sites along the central Chilean coast. Thus, the high number of species found along the central Chilean coast apparently is not a result of high search efforts but rather a true ecological phenomenon.

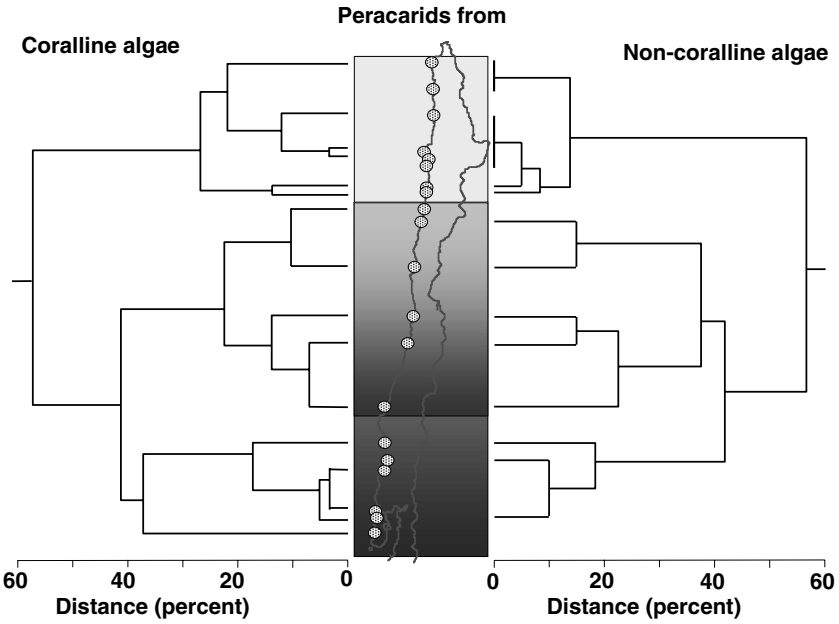

Figure 4 Cluster analysis for the epifaunal peracarid assemblages from calcareous red algae *Corallina officinalis* at 16 sampling sites along the Chilean coast during the austral summer (January/February 1999); at each sampling site $n = 6$ replicates of 8 cm^2 surface area were taken; analysis based on presence/absence data; for further details see text.

Several previous studies had remarked that in the transitional zone northern and southern species overlap (Brattström & Johanssen, 1983; Lancellotti & Vásquez, 1999, 2000). Clearly, this overlap could result in higher species numbers in this zone. Herein it was found that species from the same functional group overlapped in this transitional zone. Thus, replacement of species within a particular functional group does not occur in discrete steps but rather gradually in a zone in which two or more species from the same functional group coexist. In addition to the overlap of northern and southern species in this transitional zone, some species are restricted in their distribution to this zone (e.g. the amphipod *Ventojassa frequens* and the isopod *N. elongatus*). This restriction of some species to the central zone had also been found for other taxa (Lancellotti & Vásquez, 2000; Ojeda *et al*., 2000). In consequence, the overlap of northern and southern species together with species restricted to the transitional zone results in high species richness in this zone. This further underlines the notion that high species richness in the central zone (which coincides largely with the transitional zone) is not an artefact of high search effort.

The zoogeographical zonation along the continental Chilean coast

Most studies have revealed the existence of two biogeographical regimes along the Chilean coast, which are separated by a relatively wide transitional zone (Ekman, 1953; Brattström & Johanssen, 1983; Lancellotti & Vásquez, 1999, 2000). While there has been good agreement about the existence of these three zones, the opinions about the limits of each zone vary widely among different authors. Brattström & Johanssen (1983) concluded that a northern zone extends as far south as *c*. 32° S followed by the transitional zone that ranges south to *c*. 42° S where it is separated from the southern zone. Based on a much more complete survey, Lancellotti & Vásquez (1999) established the transitional zone between 35° S and 48° S, thus reaching much farther south and extending over more latitudes than any previous study on the zoogeography of the Chilean coast. The results of the present study appear to concur largely with the zonation pattern revealed by Brattström & Johanssen (1983), placing the transitional zone farther north than Lancellotti & Vásquez (1999). Both my study and that of Brattström & Johanssen are exclusively or largely based on material collected during 1 year while the data used in the meta-analysis by Lancellotti & Vásquez (1999, 2000) are based on information collected during varying years and seasons. Why should it matter whether a zoogeographical study is based on data collected only in 1 year or on data assimilated over varying years? The coasts of the southeastern Pacific are strongly affected by the El Niño phenomenon resulting in a strengthening of southward currents and a concurrent weakening of northward currents. It is well known that during El Niño events many invertebrate species from warm waters may be distributed southwards (Arntz & Fahrbach, 1991). This, in combination with the disappearance of local species during El Niño events, may result in a shift of the benthic assemblage composition (Arntz *et al*., 1987, 1988; Tarazona *et al*., 1988). While most of the previously mentioned studies were conducted along the Pacific coast of Peru, it is not unlikely that similar effects occur along the Chilean coast. The consequence of a range extension of northern species combined with the range reduction of southern species would be a temporary shift of biogeographical limits. In light of these considerations it is not surprising that little agreement exists about the exact location of the limits of the transitional zone along the Chilean coast, as it may oscillate in accordance with

interannual variations in the prevailing oceanic currents. Furthermore, these oscillations of the distribution limits of many shallow water invertebrates also may explain the wide extension of this transitional zone. Regardless of where the different authors place the limits of this zone, most of them agree that it extends over more than 10 latitudes (i.e. > 1500 km). Thus, in this transitional zone, species may constantly immigrate and disappear from local habitats depending on the prevailing oceanographic conditions. This could result in constant changes of benthic assemblage structure in the shallow water habitats of this zone, as was also found for algal and pelagic assemblages (Camus, 1990; Gómez-Gutiérrez *et al*., 1995, respectively). Future long-term studies are necessary in order to reveal whether biogeographical limits of benthic assemblages indeed oscillate along the Chilean coast.

The zoogeography of algae-associated peracarids along the Chilean coast

The present study was not the first attempt to utilize the distribution of peracarid crustaceans to examine the zoogeography along the Chilean coast (see Andres, 1975). Although the material available to Andres (1975) came from very unevenly dispersed sampling sites and habitats, he also revealed three different zones. His sampling sites left a large gap between *c*. 28° S and 36° S, and consequently the northern limit of his central (the transitional) zone was not well defined. He found a similar distribution pattern as in the present study with a few species restricted to each of the three zones, the northern, the central (transitional), and the southern zone. Some northern species and some southern species were found by him to overlap in the central zone. For isopods, Menzies (1962) reported a very similar distribution pattern, and he remarked that 'not one species is a member of all of the Chilean regions', i.e. extending over all three zones. Unfortunately, no such zoogeographical review is available for the tanaids from the Chilean coast.

Both Menzies (1962) and Andres (1975) discussed the distribution pattern of isopods and peracarids along the Chilean coast in relation to the dominating water masses, in particular to water temperatures. Similar to many authors working on other taxa, they discussed a close relationship between water temperature and the occurrence of peracarid species. This relationship furthermore fosters the suspicion that interannual variations of the oceanographic conditions in the study area may continuously affect the distribution range of peracarid species.

Relationship of the Chilean peracarid fauna to other areas

Many of the authors previously working on the Chilean peracarids have remarked the close affinities to the peracarid fauna from other coasts in the southern seas (Menzies, 1962; Barnard, 1972; Andres, 1975; Gonzalez, 1991). Particularly close affinities exist between peracarids from southern Chile and Australia/New Zealand (Menzies, 1962; Barnard, 1972). Many species from New Zealand are also found in the southern and central zone of Chile. Some of these southern Chilean species are also reported from South Africa and subantarctic islands. Menzies (1962) noted that several isopod genera have a wide circumsubpolar distribution. This notion is supported by the first finding of a yet unidentified species *Vermectias* sp., a genus that previously has been reported from subantarctic islands (Just & Poore, 1992). In the present study, several individuals of this species have been found in the transitional and southern zone. Similar cases can be made for several amphipod species that are well known from New Zealand (Barnard, 1972) and have also been found in the transitional and southern zone of the Chilean coast (e.g. *Gammaropsis typica*, *Ventojassa frequens*, *Niohotunga noa* and *Ischyrocerus longimanus*). Less clear is the case with species from the northern zone. Some of these species are known to have a worldwide distribution (e.g. *Ericthonius brasiliensis*) (Bellan-Santini, 1999). The peracarid fauna from the northern zone of the Chilean coast may show closer affinities to the faunas from subtropical waters north of the present study area.

All peracarids have direct development (e.g. Thiel & Vásquez, 2000), lacking a pelagic larval stage that could be considered important for transport over large oceanic distances (see, e.g. Scheltema, 1988). However, faunal similarities between South Australia/Tasmania/New Zealand and Chile are surprisingly common among organisms with short larval phases or even direct development (Barnard, 1972; Buroker *et al*., 1983; González & Edding, 1990; Ó Foighil *et al*., 1999). It has been suggested that rafting of juveniles and adults may be an important transport mechanism for organisms with direct development (Ó Foighil & Jozefowicz, 1999). Rafting could be particularly important for plant-associated fauna such as the peracarids examined in the present study. Possibly the finding of *Heterozostera tasmanica* in Chile (Phillips *et al*., 1983; González & Edding, 1990) is an indication that plants or seeds may be transported with the Antarctic Circumpolar Current, but Phillips *et al*. (1983) considered this unlikely as a dispersal mechanism. However, algal patches have been found in open ocean waters far from the next coast (Ingólfsson, 1995; Hobday, 2000a; Smith, 2002). The relatively high affinity of the algal flora particularly from southern Chile with other circumsubpolar regions (Santelices, 1980) suggests that dispersal of floating algae can occur within the strong Antarctic Circumpolar Current (Meneses & Santelices, 2000). A recent review by Castilla & Guiñez (2000) provides further indication that some fauna may on ecological time scales be distributed in the southern hemisphere south *c*. 40° S by rafting (on algae, pumice or wood) in the circumpolar currents.

Various algae-associated peracarids have been found on drift algae > 100 km from the next shore (Ingólfsson, 1995; Hobday, 2000b). Thus, rafting epifaunal peracarid species would be particularly prone to be widely distributed in the circumsubpolar region of the southern hemisphere. A comparatively high diversity of suspension-feeding amphipods that attach their tubes to the algal thalli was found in the central region of the Chilean coast. When algae are broken

from the substratum and transported by oceanic currents, the attached amphipods may be carried on these floating substrata over long distances in the Antarctic Circumpolar Current or along the Chilean coast.

The strong affinity, particularly to the New Zealand peracarid fauna (Menzies, 1962; Barnard, 1972), indicates that the zoogeography of the Chilean coast might under the present oceanic regime be influenced by occasional exchanges with other faunas in the circumsubpolar region. Particularly affected by these processes will be the transitional and the southern zone of the Chilean coast. The high species richness in the transitional zone (identified by all previous studies somewhere between 30° S and *c.* 45° S) could be a result of occasional immigration and subsequent geographical isolation of species that have reached the Chilean coast from western source regions. Whether long-distance dispersal of peracarids and other algae-associated organisms indeed occurs in the Antarctic Circumpolar Current and along the Chilean coast, as has been suggested by several authors (for most recent reports see Castilla & Guiñez, 2000; Smith, 2002), remains to be investigated in the future.

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BIOSKETCH

Martin Thiel is Assistant Professor of Marine Biology at Universidad Católica del Norte in Coquimbo, Chile. His research interests range from the behavioural ecology of marine invertebrates to the ecology of coastal habitats. During the past 5 years his research has focused on the reproductive behaviour of crustaceans and the functioning of coastal ecosystems. In addition to his behavioural studies, he presently participates in several international research projects studying the biodiversity of benthic communities.