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# Benthos of the Gorda Ridge axial valley (NE Pacific Ocean): taxonomic composition and trends in distribution

A.G. CAREY, JR[1], D.L. STEIN[1] and P.L. RONA[2]

[1]*College of Oceanography, Oregon State University, Corvallis, Oregon 97331-5503, USA*
[2]*Atlantic Oceanographic and Meteorological Laboratory, NOAA, Miami, Florida, 33149, USA*

**Abstract** — Distribution and relative abundance of invertebrate mega-epifauna and benthic fishes were studied in the Gorda Ridge central rift valley off southern Oregon and northern California, USA. Faunal distribution and relative abundance were correlated with location, geological setting, substrate type, and depth. Bottom photographs and videotapes were from 1985-1986 cruises by the US Geological Survey and the US National Oceanic and Atmospheric Administration. Voucher specimens were collected by rock dredge, fish trap, and the Deep Submergence Vehicle (DSV) *Sea Cliff*.

Location rather than substrate appears to have more effect on the overall taxonomic composition of the mega-epifauna in the northern and southern parts of the rift valley. Within each location, substrate type, i.e. soft sediments and rock outcrops, and percentage cover of these substrates appear to influence the existing faunal composition. Characteristic fauna are associated with each substrate type, e.g. crinoids, gorgonians and sponges (Demospongiae) on rocky surfaces. In the southern sediment-filled Escanaba Trough, deposit-feeding organisms, particularly ophiuroids, asteroids and holothuroids, are interspersed with stalked suspension feeders, such as hexactinellid sponges and pennatulids. Epifaunal community structure in the northern and southern sectors differs, even on similar substrate combinations. Except for the ubiquitous macrourids, fish species distributions may be correlated with substrate type. Abundant particulate material in the bottom water layer probably accounts for large concentrations of suspension and detritus feeding epibenthos.

## 1. INTRODUCTION

The Gorda Ridge axial valley contains an abundant and diverse epifauna including soft sediment and hard substrate fauna (CAREY, STEIN, TAGHON and RONA, 1990). Photographic data primarily from DSRV *Alvin* dives in 1984 indicated that the faunal composition changes along the valley floor at depths of 3,200m, probably in response to topography as well as to varying substrate type.

Three animal assemblages appear to characterize the major geological zones (CAREY, *et al*, 1990). The northern fauna is predominantly suspension-feeding epifauna associated with basalt rock in the narrow, steep canyon-like axial valley. The middle valley fauna includes similar taxa, but in the constricted portions of the central valley the taxonomic composition changes from crinoid-dominated to an ascidian-dominated fauna. In the southern sediment-filled Escanaba Trough stalked suspension feeders are intermixed with a deposit-feeding taxa. Portions of the rocky central valley may support larger standing stocks of mega-epifauna consisting primarily of ascidians. Ophiuroids and holothuroids, especially *Paelopatides confundens*, may be abundant and ubiquitous because of their ability to feed on surface detritus on both sediments and rocks.

Many of these sedimentary deposit-feeders, such as asteroid, holothuroid and ophiuroid species, occur on the surrounding abyssal plains (CAREY, 1990).

The input of suspended particulate material is probably enhanced in the valley benthic boundary layer by: (1) topographic entrainment of bottom currents, (2) the southwestern advection of continental run-off by the Columbia River plume in the summer, and (3) the primary chemosynthetic production associated with hydrothermal venting (CAREY *et al*, 1990), supporting the higher standing stocks of suspension-feeding benthos in the northern axial valley environment. CAREY *et al* (1990) suggested that faunal abundance results from continental run-off, transported offshore by the Columbia River plume and subsequent topographic concentration of suspended particles. *In situ* bacterial chemosynthetic primary production, associated with hydrothermal venting processes in the Gorda Ridge axial valley seafloor spreading centre, may provide an additional energy source for the benthic fauna.

In this paper we describe the relationship of location and substrate type with taxonomic composition and feeding type of the mega-benthos associated with deep-sea ridges. Though a characteristic fauna is associated with purely rock and purely sediment substrates, the effect of intermediate substrate mixtures on faunal composition is unknown. Our major objectives are: (1) to describe the taxonomic composition and relative abundance of the visible megafauna, and (2) to determine the effects of varying substrate combinations, bathymetry, and location on the taxonomic composition and feeding type of the fauna.

### *1.1 Geological and Oceanographic Setting*

The 300km long Gorda Ridge roughly parallels the coasts of southern Oregon and northern California 200-300km offshore (Fig.1). Its axial valley is 3-10km wide within fault scarps (ATWATER and MUDIE, 1973; RIDDIHOUGH, 1980; CLAGUE and HOLMES, 1987). The ridge has three major geological zones - northern, central, and southern. Each is distinguished by characteristic spreading rates and geological features and is defined by east-west trending transverse faults. The northern zone has a moderate spreading rate of 5.5cm $y^{-1}$ (RIDDIHOUGH, 1980), though its physiography closely resembles that of the slow-spreading Mid-Atlantic Ridge. Its axial valley is 3,000-3,700m deep with a vertical relief of 600-1400m. Though sedimentation rates of 5.6 and 15.0cm 1,000$y^{-1}$ exceeded those for abyssal environments further removed from continental influences (KARLIN and LYLE, 1986), it has little sediment cover (DAVIS and CLAGUE, 1987). Active hydrothermal vents and chimneys occur in the northern valley at Station GR-14 on the inner eastern valley wall (RONA, DENLINGER, FISK, HOWARD, KLITGORD, MCCLAIN, MCMURRAY, TAGHON and WILTSHIRE, 1988).

The central segment of the rift valley, lying between the two transform fault zones, begins at 42°N where the President Jackson Sea Mount Chain intersects the ridge. It consists of a narrow, deep rift valley with exposed basalts. Spreading rate is slow with an estimated full rate of 2.2cm $y^{-1}$ (RIDDHOUGH, 1980). South of this intersection, the axial valley widens and deepens to become Escanaba Trough. Indications of hydrothermal activity in the central zone are inconclusive (BAKER, MASSOTH, COLLIER, TREFRY, KADKO, NELSEN, RONA and LUPTON, 1987).

The southern zone, Escanaba Trough, has the widest profile and the most sediment (MOORE, 1970). These sediments are derived primarily from turbidites that cascaded down the adjacent Oregon and California continental slopes and along the floor of Gorda Basin. The Mendocino Escarpment funnelled the sediment flows into the southern axial valley (VALLIER, HAROLD andGIRDLEY, 1973). Igneous protrusions pierce the sediment cover along the valley axis and are the site of massive sediment-hosted polymetallic sulphide deposits and active hydrothermal

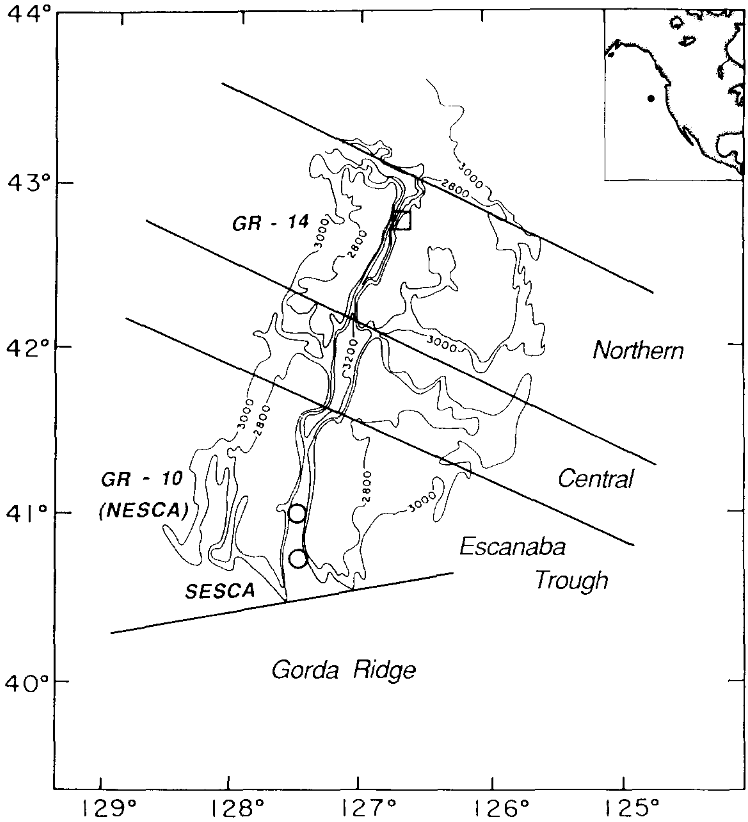


FIG.1. Location map of 1985 and 1986 USGS and NOAA stations. Invertebrate data were derived from one camera tow at Station GR-14 in the northern valley and two at Station GR-14 (NESCA) in the southern valley. Fish distribution data were derived from 8 video transects on the eastern wall in the northern valley adjacent to Station GR-14. Fish specimens were trapped at Stations NESCA and SESCA. Note the geological/ecological zones that are indicated on the topographic chart. Depth contours in metres.

venting (MORTON, HOLMES and KOSKI, 1987; CLAGUE and HOLMES, 1987; ZIERENBERG, KOSKI, SHANKS and SLACK, 1988).

The Columbia River plume extends over the Gorda Ridge during summer (CONOMOS and GROSS, 1972). Its extensive outflow is advected by wind stress to the southwest as a lens of low salinity water (BARNES, DUXBURY and MORSE, 1972), containing particulate material and terrestrial debris.

## 2. MATERIALS AND METHODS

Our studies are based on bottom photographs and video images from towed camera vehicles operated by the US Geological Survey (USGS) and the US National Oceanic and Atmospheric Administration (NOAA) and by submersible operations of the US Navy (MORTON *et al*, 1987; CHEZAR and LEE, 1985) (Fig.1). Data were derived from several camera tows. One trackline ranged from 3,100-3,200m in depth along the floor of the northern sector of the valley. The tow was made in the Station GR-14 area (44°44.7'N, 127°43.7'W) during the 1986 Gorda Ridge cruise of the NOAA ship *Surveyor*. Two tows in Escanaba Trough to the south were made by the USGS on board R/V *S.P. Lee* (3,200-3,320m) at station GR-10 (NESCA) on cruises L6-85-NC (41°00.70'N, 127°28.64'W) and L1-86-NC (40°58.51'N, 127°30.12'W). Fish data were derived from videotapes recorded on 8 camera tracklines at and around Station GR-14 at depths between 2,250-3,200m on the east wall of the northern rift valley. Invertebrate and fish voucher specimens for taxonomic study were collected by rock dredge tows (USGS), DSV *Sea Cliff*, and *in situ* fish trapping (Oregon State University).

To analyze the photographs, they were back-projected with a Variscan aerial photogrammetric analyzer (Mark II, Westwood Division, Houston Fearless Corp, Los Angeles, CA.). Altitude estimates for the photographs were generated from standard Precision Depth Recorder plots of the sea floor and the camera system pinger traces. Comparisons of measurements of known fauna in the bottom photographs with size data from previous deep-sea survey studies provided scale confirmation (CAREY, unpublished data). Photographs were classified according to percent rock and sediment cover.

Camera altitudes of 2-3m were chosen to maximize the number of usable photographs and the accuracy of identification and quantification. The few photographs taken at lower altitude were frequently out of focus. Smaller megafauna, e.g. ophiuroids, were indistinguishable at higher altitudes on either rock or sediment backgrounds. Numbers differed significantly at the high and low altitudes, largely because of differing counts of smaller megafauna. Because the data are few in portions of the data matrix, conclusions should be considered as trends only (Table 2).

## 3. RESULTS

The invertebrate epifauna and benthic fishes are diverse (Table 1). The former are a mixture of typical abyssal rocky epifauna and soft-bottom mega-epifauna. No species characteristic of hydrothermal vent regimes were observed or collected.

Relative abundances (percent taxonomic composition) of major taxa were compared across percent rock cover categories at the two ends of the axial valley (Table 2, Fig.2). Least squares regression analysis suggests that location in the northern or southern end of the valley is a better predictor of the faunal composition than percent rock cover. Location appears important for ophiuroids, asteroids, holothuroids, and zoantharia (actiniarians, cerianthids, and zoanthids), while percent rock cover tends to be a major influence for crinoids only. Crinoids, however, are a greater component of the epifauna to the north in the rocky, narrow valley (up to 20.8% on mixed substrates) than in the sedimented southern valley (2.3% on 41-60% rock cover).

The contrasting environments in the north and south influence the overall faunal composition. Taxonomic composition differs between the northern and southern sectors even when the local percent rock and sediment cover and water depth are similar (Table 2). Thus, fauna generally associated with sediments, e.g. asteroids and holothuroids, comprise a larger proportion of the southern community than in the northern sector of the valley where basalts predominat (Table 2).

The above data indicate that ascidians remain a small component of the benthic assemblage in the northern segment of the valley. CAREY *et al* (1990) reported that ascidians are abundant and dominate the central zone epifauna. Confirmation of this distribution and an explanation for it remain unknown.

In the sediment-laden Escanaba Trough abyssal sediment epifauna were relatively more abundant than in the rocky northern valley segment. Holothuroids (e.g. *P. confundens* and *Abyssocucumis abyssorum*) were major population components only where there was 100%

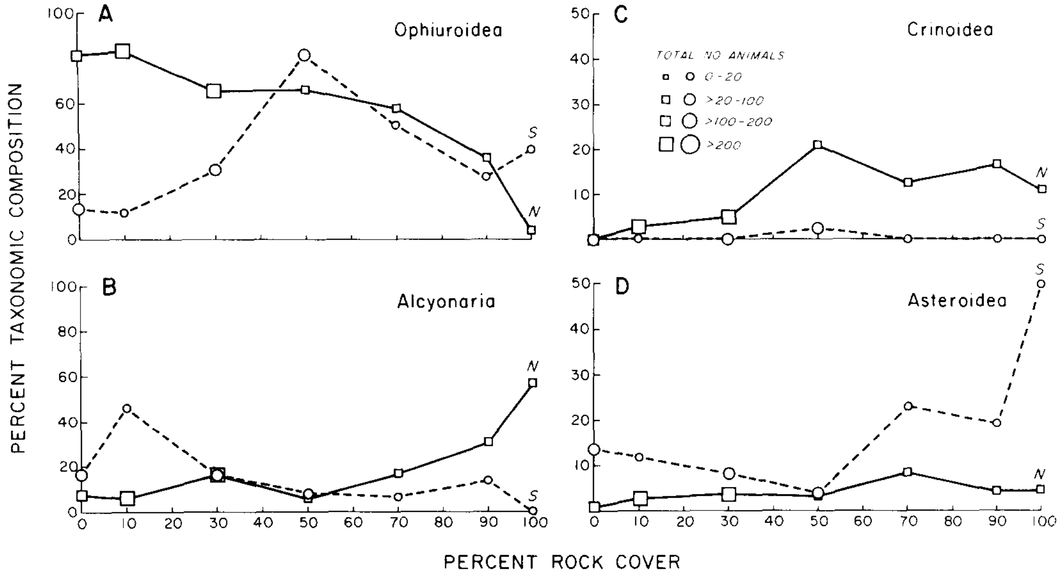


FIG.2. Percent composition of four most abundant taxonomic groups in the northern and southern Gorda Ridge axial valley. Note the scale change for graphs C and D. The total number of animals counted in each category is indicated by the relative size of the data point symbols. N = north, S = south.

The northern steep-sided valley is characterized by stalked, hard substrate fauna, such as poriferans (Demospongiae), alcyonarians, and crinoids, while in the sediment-filled Escanaba Trough the abundant taxa include ophiuroids and holothuroids. However, where sediments have accumulated in shallow pockets in the rocky northern section, mixtures of fauna are found. Certain taxonomic groups are relatively more abundant at intermediate rock-sediment combinations rather than 100% rock or sediment. In contrast to scarps and pillow lavas, talus slopes along the base of fault scarps in the northern segment are generally devoid of fauna, indicating an unstable environment.

Within either location, substrate affects the fauna present. Trends in taxonomic composition are generally different in the sediment-starved northern valley and the sediment-laden Escanaba Trough (Fig.2). For example, ophiuroids generally are the predominant component of the mega-epifauna. At the northern station (GR-14) they steadily decline in numbers with increasing rock cover and decreasing sediment. However, they are the largest component of the megafauna in Escanaba Trough at intermediate rock-sediment mixtures. Alcyonaria (soft and hard corals) exhibit the opposite trend in relation to rock cover. In the north they increase in relative abundance with increasing rock cover, but they decline in importance in the south with increasing hard substrate. Asteroids form 0-11.1% of the population to the north, but increase to 50% of the mega-epifauna in the south on complete rock cover. Some other taxa, though forming less important components of the megafauna, also demonstrate marked differences between the rocky northern and the predominantly sedimentary environments to the south (Table 2). Zoantharia, for example, range up to 23.7% of the fauna in the south, though they reach only a maximum of 4.5% in the north. In both the northern and southern valley, holothuroid species, which are sediment surface deposit-detritus feeders, are more abundant where the sediment cover is 100% than in habitats with mixed substrates. In contrast, alcyonarians and zoantharians, normally associated with hard substrates, become more abundant as hard substrate increases.

TABLE 1. Summary of benthic taxa observed, collected, and identified from the Gorda Ridge axial valley 1984-1987. (* - new species).

| | | | | |
|---|---|---|---|---|
| **PORIFERA** | | | | |
| | **Class** | **HEXACTINELLIDA** | | |
| | | **Subclass** | **Amphidiscophora** | |
| | | | **Family** | Hyalonematidae |
| | | | | *Hyalonema* sp. |
| | | | | *Hyalonema* cf. *apertum* Schultze 1887 |
| | | | **Family** | Euplectidae |
| | | | | *Leroyella* sp.? |
| | | | **Family** | Rossellidae |
| | | | | *Aulochone lilium* Schultze 1887? |
| | | | | *Staurocalyptus fasciculatus* Schultze, 1899 |
| | | | | *Staurocalyptus* sp.nr. *fasciculatus* Schultze, 1899 ? |
| | | | | *Rhabdocalyptus* sp.nr. *R dawsoni* (Lambe, 1892) |
| | | | **Family** | Farreidae |
| | | | | *Farrea occa* Bowerbank 1862 ? |
| | | | | *Farrea aculeata* Schultze 1899 |
| | | | **Family** | Aphrocallistidae |
| | | | | *Aphrocallistes vastus* Schultze 1887 |
| | **`Class** | **DEMOSPONGIAE** | | |
| | | | **Family** | Axinellidae |
| | | | | *Phakettia* sp. |
| | | | **Family** | Cladorhizidae sp. |
| | | | **Family** | Suberitidae |
| | | | | *Suberites* sp.? |
| **CNIDARIA** | | | | |
| | **Class** | **Anthozoa** | | |
| | | **Subclass** | **Alcyonaria** | |
| | | | **Family** | Isididae |
| | | | | *Keratoisis/Lepidsis* sp.1 |
| | | | | *Keratoisis/Lepidsis* sp.2 |
| | | | **Family** | Primnoidae |
| | | | | *Calyptrophora* sp.? |
| | | | | *Narella* sp.cf. *bowersi* (Nutting 1912) |
| | | | **Family** | Virgulariidae sp. |
| | | **Subclass** | **Zoantharia** | |
| | | | **Family** | Heterotaeniales |
| | | | | *Antipathes* sp. |
| | | | | *Bathypathes* sp. |
| | | | | *Cerianthus* sp. |
| | | | **Family** | Epizoanthidae |
| | | | | *Epizoanthus/Isozoanthus* sp. |
| | | | **Family** | Phymanthidae |
| | | | | Mesomyaria sp. |
| | | | **Family** | Actinostolidae |
| | | | | *Actinostola spetsbergensis* (Carlgren 1893) ? |
| | | | **Family** | Actinoscyphiidae |
| | | | | *Actinoscyphia* sp. |
| **MOLLUSCA** | | | | |
| | **Class** | **CEPHALOPODA** | | |
| | | **Subclass** | **Coleoidea** | |
| | | | **Family** | Octopodidae |
| | | | | *Octopus* sp.? |
| | | | | *Cirroteuthis* sp. |
| | **Class** | **BIVALVIA** | | |
| | | **Subclass** | **Heterodonta** | |
| | | | **Family** | Malletiidae |
| | | | | *Malletia (Malletia) truncata* Dall, 1908 |
| **ANNELIDA** | | | | |
| | **Class** | **POLYCHAETA** | | |
| | | | **Family** | Sabellidae |
| | | | | *Fabrisabella* sp. |
| **ANTHROPODA** | | | | |
| | **Class** | **CRUSTACEA** | | |
| | | | **Family** | Galatheidae |
| | | | | *Munidopsis* sp. |
| | | | | *Munidopsis latirostris* (Henderson 1885) |
| | | | **Family** | Pasiphaeidae |
| | | | | *Parapasiphae sulcatifrons* Smith 1884 |
| | | | **Family** | Oplophoridae |
| | | | | *Hymenhodora frontalis* Rathbun, 1902 |
| | | | **Family** | Petalophthalmidae |
| | | | | *Petalophthalomus armiger* Wilemoes-Suhm 187 |
| | | | **Family** | Phronimidae |
| | | | | *Phronima sedentaria* (Forskaal) 1775 |

**ECHINODERMATA**

**Class STELLEROIDEA**

**Subclass Asteroidea**

**Family** Luidiidae
*Luidia* sp.?

**Family** Echinasteridae
*Echinaster* sp.?

**Family** Brisingidae
*Freyella* cf. *insignis* Ludwig 1905

**Family** Pterasteridae
*Hymenaster perissonotus* Fisher 1910

**Family** Asteriidae

**Subclass Ophiurida**

**Family** Ophiuridae
*Ophiocten hastatum* Lyman, 1878?
*Ophiomusium multispinum* Clark 1911?

**Family** Ophiacanthidae
*Ophiocantha* sp.a
*Ophiocantha* sp.b
*Ophiocantha* sp.c

**Class CRINOIDEA**

**Subclass Articulata**

**Comatulida sp.**
*Rhizocrinus* sp.

**Family** Bathycrinidae
*Bathycrinus* sp.a
*Bathycrinus* sp.b

**Cyrtocrinida sp.**

**Family** Hyocrinidae
*Ptilocrinus pinnatus* AH Clark 1907?
*Thalassocrinus* n.sp.*

**Class HOLOTHUROIDEA**

**Family** Cucumaridae
*Abyssocucumis abyssorum* (Theel 1886)

**Family** Synallactidae
*Paelopatides confundens* (Theel 1882)
*Synallactes* sp.a?
*Synallactes* sp.b?

**Class ECHINOIDEA**

**Subclass Euechinoidea**

**Family** Urechinidae
*Urechinus loveni* (A Agassiz 1898)?

**CHORDATA**
**Subphylum UROCHORDATA**

**Class ASCIDIACEA**

**Family** Pyuridae
*Culeolus sluiteri* Ritter, 1913
*Culeolus pyramidalis* Ritter, 1907
*Culeolus* sp.
*Bathypera ovoida* (Ritter, 1907)

**Family** Ascidiidae
*Ascidia* n.sp.*

**Family** Molgulidae?

**PISCES**

**Class OSTEICHTHYES**

**Family** Macrouridae
*Coryphaenoides armatus* (Hector 1875)
*Coryphaenoides ?filifer* (Gilbert 1895)
*Coryphaenoides leptolepis* Gunther 1877

**Family** Moridae
*Antimora microlepis* Bean 1890

**Family** Ophidiidae
*Spectrunculus grandis* (Gunther 1877)

**Family** Zoarcidae

**Family** Liparididae
*Paraliparis ?rosaceus* Gilbert 1890

**Family** Synodontidae
*Bathysaurus mollis* Gunther 1878

TABLE 2. Percent taxonomic composition of the visible benthic epifauna versus substrate at 2-3m altitude in the Gorda Ridge axial valley.

| Percent Rock Cover | Ophiuroidea | Alcyonaria | Crinoidea | Asteroidea | Holothuroidea | Porifera | Zoantharia | Urochordata | Arthropoda | Pisces | Echinoidea | No.of Frames | No.of Individuals |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A. NORTHERN GORDA | | | | | | | | | | | | | |
| 0 | 81.2 | 7.3 | - | 0.7 | 10.0 | 0.3 | 0.3 | 0.2 | - | - | 0.3 | 25 | 150 |
| 1-20 | 83.0 | 5.7 | 2.4 | 2.4 | 2.3 | 2.6 | 0.6 | 0.3 | 0.5 | 0.1 | - | 65 | 737 |
| 21-40 | 65.8 | 15.5 | 5.1 | 3.6 | 1.0 | 6.8 | 2.2 | 0.4 | - | 1.1 | - | 38 | 368 |
| 41-60 | 66.7 | 5.5 | 20.8 | 3.2 | - | 1.4 | - | 1.4 | - | - | - | 7 | 54 |
| 61-80 | 58.3 | 16.7 | 12.5 | 8.3 | - | 2.1 | 2.1 | - | - | - | - | 6 | 30 |
| 81-99 | 36.3 | 30.3 | 16.6 | 4.5 | - | 4.5 | 4.5 | 3.0 | - | - | - | 10 | 44 |
| 100 | 3.9 | 56.8 | 11.0 | 4.5 | 2.4 | 6.9 | - | 3.0 | 2.4 | - | - | 11 | 54 |
| B. SOUTHERN GORDA (ESCANABA TROUGH) | | | | | | | | | | | | | |
| 0 | 12.3 | 16.5 | - | 13.5 | 42.6 | 0.9 | 12.6 | - | 0.9 | 0.9 | - | 52 | 56 |
| 1-20 | 11.7 | 45.8 | - | 11.7 | - | 18.2 | 12.7 | - | - | - | - | 10 | 16 |
| 21-40 | 30.9 | 16.0 | - | 8.0 | 9.4 | 2.0 | 22.3 | 11.4 | - | - | - | 17 | 49 |
| 41-60 | 82.0 | 7.8 | 2.3 | 3.9 | - | - | - | 3.1 | 0.8 | - | - | 16 | 64 |
| 61-80 | 51.0 | 6.3 | 0 | 22.9 | 3.1 | - | 16.7 | - | - | - | - | 7 | 20 |
| 81-99 | 27.3 | 13.6 | - | 18.2 | 13.6 | - | 27.3 | - | - | - | - | 10 | 16 |
| 100 | 40.0 | - | - | 50.0 | - | - | 10.0 | - | - | - | - | 2 | 10 |

TABLE 3. Numbers of each fish taxon identified along depth transect on the eastern wall of the northern Gorda Ridge axial valley. Parentheses signify uncertain identification.

| Depth (m) | Macrouridae | | Ophidiidae *Spectrunculus grandis* | | Moridae *Antimora microlepsis* | | Zoarcidae | | Liparidae | | Unknown | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2,550 | 10 | (2) | 1 | (-) | 4 | (6) | - | (1) | - | (1) | 6 | 31 |
| 2,600 | 11 | (8) | 3 | (-) | 1 | (-) | - | (2) | - | (-) | 2 | 27 |
| 2,600 | 9 | (3) | - | (3) | 4 | (1) | 2 | (1) | - | (-) | 3 | 26 |
| 3,000 | 2 | (7) | - | (2) | - | (1) | - | (-) | - | (-) | 6 | 18 |
| 3,050 | 12 | (2) | 1 | (1) | - | (-) | 1 | (-) | 2 | (-) | 4 | 23 |
| 3,050 | 2 | (1) | - | (-) | - | (-) | - | (-) | - | (-) | 3 | 6 |
| 3,100 | 2 | (2) | 3 | (2) | - | (-) | 2 | (1) | 1 | (-) | 3 | 16 |
| 3,200 | 5 | (-) | 5 | (2) | - | (-) | 1 | (2) | - | (-) | 8 | 23 |
| TOTALS | 53 | (25) | 13 | (10) | 9 | (8) | 6 | (7) | 3 | (1) | 35 | 170 |

Fishes were relatively abundant (170 individuals seen) on the videotape records from nine stations in the northern sector of the valley (Table 3). At least five different taxa occur in the valley (in order of abundance): *Coryphaenoides armatus* and other Macrouridae (53 definite, 25 questionable), *Spectrunculus grandis* (Ophidiidae) (13,10), *Antimora microlepsis* (Moridae) (9,8), Zoarcidae (6,7), and Liparididae (3,1). There appeared to be differences in the frequency of occurrence of each taxon on different substrates. Macrourids were about evenly distributed on soft and rocky bottoms; *S. grandis* and zoarcids were more abundant on rocky bottom; and *A. microlepis* on soft bottom. The rattails (*Macrourids*) were more abundant off-axis in the northern axial valley than on the valley floor (Table 3).

## 4. DISCUSSION

Our studies with bottom photographic and video imaging suggest that low altitudes (<2m) are necessary to obtain quantifiable data on benthic invertebrates. Most faunal identifications, based on bottom photographs and video images, remain at fairly high taxonomic levels. Scarcity of voucher specimens prevented confirmation of many identifications. For ichthyological surveys, continuous video records are more useful than intermittent still photographs because the characteristic movement of fishes provides a clear clue to their presence. More accurate identification of fish species is possible from well-exposed photographs in clear focus than from video imaging. Unequal area coverage between the two techniques may bias the abundance estimates, although optical techniques could adjust the equitability of areas viewed. The solution to this problem lies in use of the much higher resolution video cameras now becoming available.

The overall patterns of distribution and relative abundance are similar to those previously reported from submersible photographs (CAREY *et al*, 1990), though some differences are apparent. Crinoids and alcyonarians predominate in the northern zone. However, ophiuroids were found to be the most numerous taxon in this study in the northern and southern valley; they were correlated with large sediment patches (Table 2). CAREY *et al* (1990) reported that sponges and crinoids were the most abundant groups in the north. The 1984 submersible photographic coverage probably was biased toward rocky environments, whereas the 1985 and 1986 towed camera transects covered relatively more sedimented areas. These differences in data acquisition and the patchiness of faunal distributions probably explain the contrasting relative abundance of the poriferan and ophiuroid faunas in the two studies.

sediment cover, but also occur occasionally on rocks, where they presumably ingest the thin detrital cover that often coats rock surfaces. Hexactinellid sponges, e.g. *Hyalonema* sp., occur primarily on sediments. The high densities of asteroids (*Echinaster* sp.?) on rocks may be correlated with hydrothermal sulphur deposits (Table 2, Fig.2). Chemosynthetic bacteria may be utilizing sulphur coatings on the rocks associated with Station NESCA, one of the volcanic protrusions along the valley axis (Morton *et al*, 1987; R. Koski, personal communication) and could form additional food materials for surface detritus feeders. Macrourid fishes were more abundant on the eastern wall in the northern valley, possibly because more food was available as a result of chemosynthesis in hydrothermal vents and entrained bottom currents (Table 3). Local conditions of food quality and supply will be expected to influence both abundance and taxonomic composition of the animal assemblages.

Our data suggest that the fauna of the Gorda Ridge axial valley is abundant and diverse, probably in response to the high concentrations of particulate materials in the bottom water layer. Though the mega-epifauna in the northern and southern regions of the rift valley are typically hard substrate or sedimentary fauna, ubiquitous taxa, such as ophiuroids, create significant overlap in community structure. Location and surrounding geological setting appear to have a major effect on the epifaunal taxonomic composition. Locally, substrate type influences the taxonomic composition and the feeding type of the invertebrate assemblage.

## 5. ACKNOWLEDGEMENTS

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