TABLE OF CONTENTS

SECTION **PAGE**

LIST OF FIGURES

LIST OF TABLES

3.0 BIOLOGICAL ENVIRONMENT

3.1 Terrestrial Ecosystem

The regional and local study area is located in the bio-geographic unit of Peru known as a coastal desert. The coastal desert of central Peru is characterized by the absence of precipitation, with only drizzles in the areas near the sea. Since the interior lands along the coast do not have drizzles and precipitation, the vegetation is very scarce or absent. Regarding vegetation, the coastal desert of central Peru has small areas with the following communities: i) Hillocks, (ii) Tillandsia fields ("Tillandsiales"), iii) Wet rocks near the sea, iv) Grass fields ("Gramadales"), v) Riverside woodlands and, vi) "algarrobo" woods (*Prosopis cf. pallida*) especially in the Department of Ica. Of these communities, the hillocks and the riverside woodlands are more diverse with fauna and flora. The vegetation is absent in the greatest part of the coastal desert of central Peru.

According to the ecological map of Peru (ONERN, 1996), the study area is in the life zone called "Dry Subtropical Desert" (Desierto Desecado subtropical). It has an annual precipitation ranging from 15 to 31 mm corresponding to the condensation of the coastal fogs, and a temperature ranging from 13 and 28 °C. The Thornthwaite method (Senamhi, 1988) describes very well the climate of the study area, corresponding to $E(d)B'_1 H_3$, having the following characteristics:

- Effective Precipitation: Arid
- Precipitation distribution during the year: Absence of rains in all the seasons,
- Temperature efficiency: Semi-hot,
- Atmospheric Humidity: Humid

3.1.1 Flora

The study area comprises the coastal desert located between the south of Cañete River and the north of Topara Creek. It is a relatively flat area, near the sea but separated from it by high cliffs. However, in the area of influence at the Cañete River (north of Pampa Clarita), the presence of riverside woodland moderately modified by agriculture was observed. A total of 113 plants were observed in the study area, 49 species of cultivated plants (Table 3-1), and 84 species of non-cultivated plants, most of them comprised of plants that are classified weeds (Table 3-2). In Pampa Melchorita the flora is very scarce with only a few small areas with Tillandsia fields noted, as well as the presence of lichens at the top of some hills at the southeast side of the property.

The "Tillandsia fields" constituted mainly by the Bromeliaceae plant known as "cardo de las lomas" *Tillandsia latifolia*, are located on sandy soils, sometimes in flat and uniform terrains (Figure 3-1) or on small undulations of the terrain (Figure 3-2). These plants have a distribution pattern in form of "patches" and within them the plants grow forming more or less parallel rows (Figure 3-3). This layout allows a better absorption of the atmospheric humidity by the leaf hairs. Additionally, lichens such as *Buellia sp.* and *Chrysothrix sp.* grow over the dead plants (Table 3-3, Figure 3-4). It is estimated that the "Tillandsia fields" cover an area of approximate 2,500 m^2 in the Pampa Melchorita study area. The *Tillandsia latifolia* is an endemic plant of Peru, reported in the departments of La Libertad, Ancash, Ica, Lima, Piura and Tacna.

At the upper part of some of the hills in the study area, five species of lichens were also observed growing sparcely over the rocks (see list of species at Table 3-3).

Figure 3-1. Tilandsials over sandy soils

Figure 3-2. Tilandsials over undulating terrain

Figure 3-3. Distribution of Tilandsials

Figure 3-4. Tilandsial – Lichen Association

3.1.2 Fauna

Turkey buzzards ("black-head turkey buzzard" *Coragyps atratus* and "red-head turkey buzard" *Cathartes aura*,) and seagulls ("Peruvian seagull" *Larus belcheri* and "Dominican seagull" *Larus dominicanus*) were commonly observed at the desert areas, and near the cultivated areas, doves ("Cuculí" *Zenaida meloda*), hummingbirds ("Amazilia costeña" *Amazilia amazilia*,) and "Chisco" (*Mimus longicaudatus*) were also observed.

The marine fauna (birds and mammals) associated with the study area, identified during the autumn and spring surveys conducted in the year 2002 are described in a greater detail at section 3.2.2.3 of this chapter. Some of the marine species (birds, mammals and reptiles) observed during surveys or seen by local fisherman are migratory species that uses the study area as part of their migratory routes but no evidences of their mating or feeding grounds were encountered at the projected plant site and vicinities. Also, some of this species are listed at the national and international protected species lists (see Table 15 in Chapter Four).

During the terrestrial surveys, footprints of *Rattus sp* were observed mainly at the edge of the cliffs; the presence of some other species was not recorded during the surveys, but according to the literature reviewed the following species could be present at coastal desert areas of central Peru: mice of the genus *Phyllotis*, "zorro costeño" or "Coastal fox" *Lycalopex sechurae,* and the reptiles *Microlophus peruvianus*, *Microlophus Teresiae*, *Phyllodactylus gersophygus* and *Alsophis elegans;* neither of this species are listed as protected species in Perú by the Supreme Decree No.013-99-AG.

3.2 Marine Ecosystem

To characterize the marine environment at the study area, the proposed trestle was used as a reference point to set a grid of marine sampling stations for the evaluation of inter-tidal and Subtidal communities. The southern boundary of the grid was located 1500 meters of the proposed trestle structure and the northern boundary at 3000 meters from the same structure, this grid also extended offshore from the shoreline to a water depth of 17 meters. The sampling was conducted in two periods of the year, June of 2002 and October of 2002 to seasonally characterize the autumn and spring periods, respectively.

3.2.1 Sampling Methodology

The sampling grid was initially defined for the autumn sampling period (June 2002) as a set of seven (7) transect lines extending at an angle of 240º from the shoreline to an offshore position defined at the water depth of 17 meters (see Figure 3-5). The projected trestle was designated as the transect number 3 (T3) on this original sampling grid. Later, during the spring sampling period (October 2002), the sampling grid was modified to include a new transect line so a total of 8 transect lines were sampled during this period. The subsequent modification of the sampling grid consisted of changing the positions of the initially designated transect lines 5, 6 and 7 (designated as T5, T6 and T7) to insert a new transect line as shown on Figure 3-6. The UTM coordinates of the surveyed stations during autumn and spring periods are shown on Tables 3-4 and 3-5, respectively.

The marine survey area, depicted by the transect lines, is comprised of two types of environments, corresponding to the shoreline where organisms highly interact with the tides (intertidal zone) and to the submerged area with where there is very little influence from tidal variations, the so called subtidal zone. Although these two types of environments appear to be distinct, they interact in the trophic chain, as a whole ecosystem forming a sandy beach environment such as is the case at Pampa Melchorita.

Figure 3-5: Autumn Sampling Stations (Grid 1), June 2002

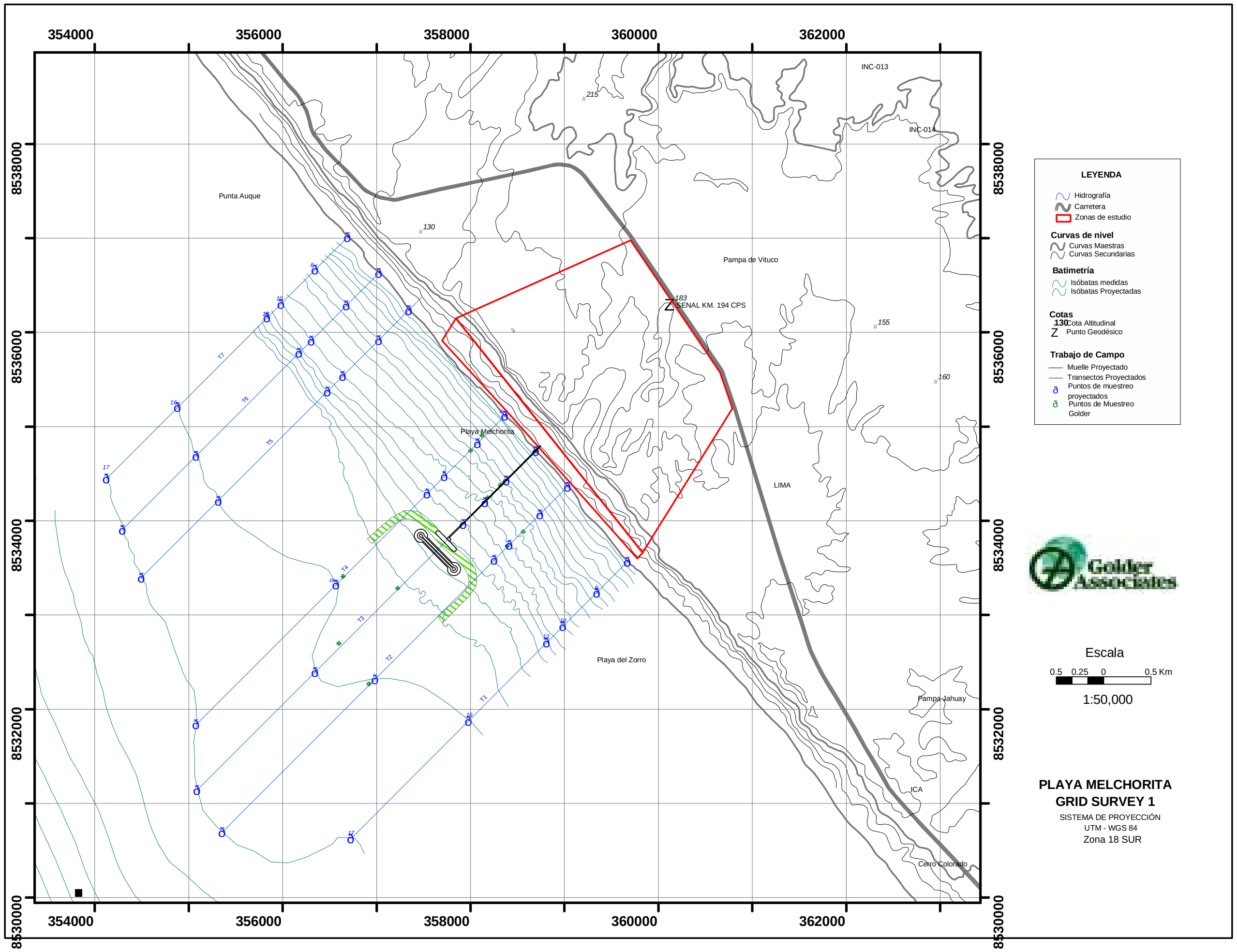
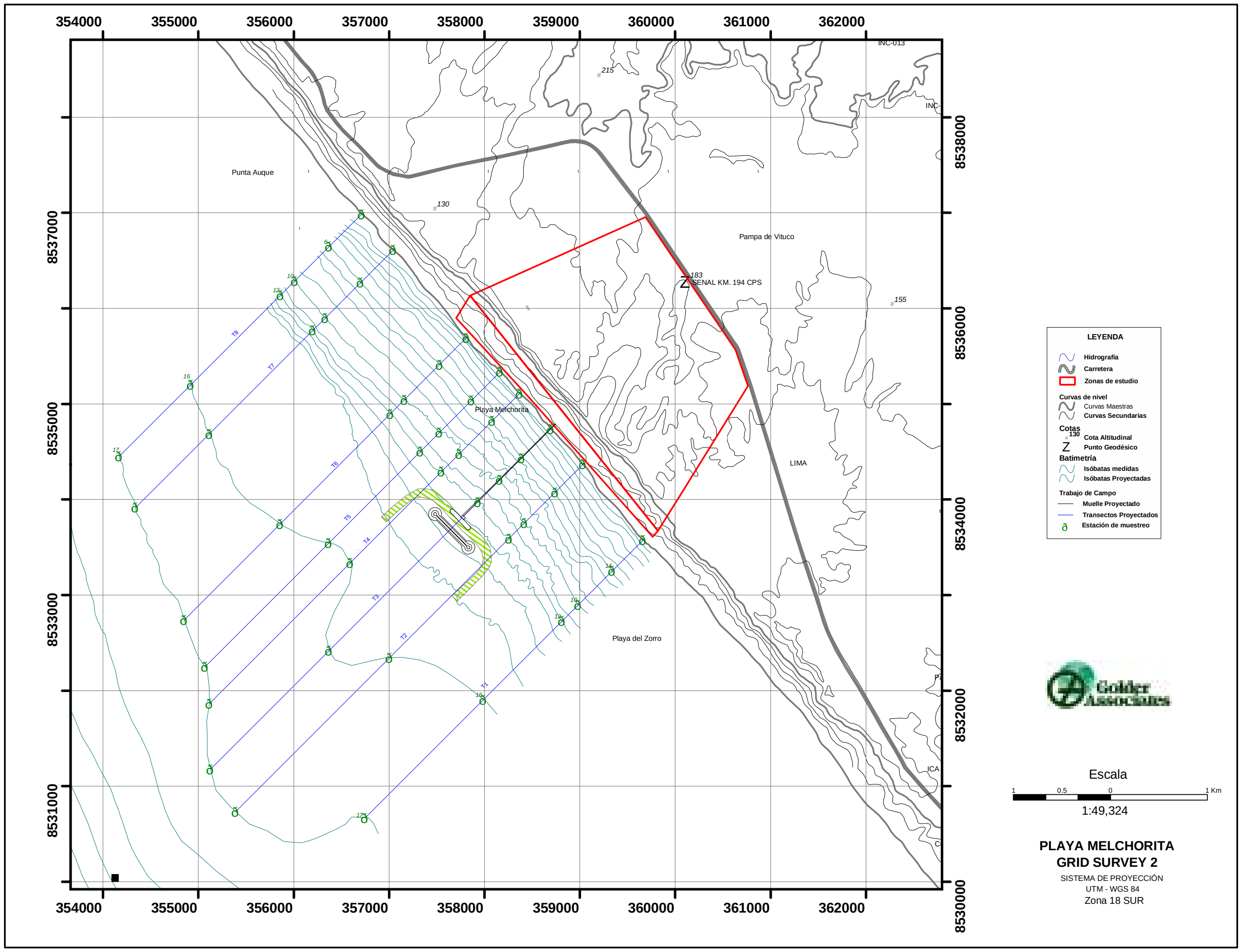


Figure 3-6: Spring Sampling Stations (Grid 2), October 2002



Each intertidal sampling station was further subdivided into four sampling zones consisting of: 1) the dry zone (Z SEC), 2) retention zone (Z RET), 3) upwelling zone (Z RES) and 4) saturation zone (Z SAT) as depicted on Figure 3-7.

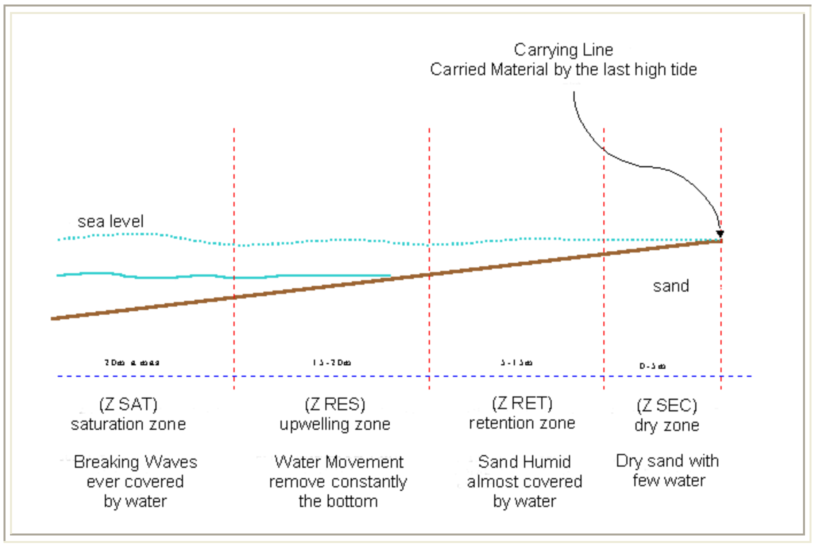


Figure 3-7. Intertidal Sampling Zone at Sandy Beach

Sampling in the subtidal zone was conducted at locations along transects that correspond to water depths of 6, 10, 12, 16 and 17 m. At each of these locations, samples were collected at three intervals at the following water column levels surface, medium and bottom. A total of 25 sampling stations were evaluated during the autumn sampling period and 32 stations during the spring period (See Figure 3-8).

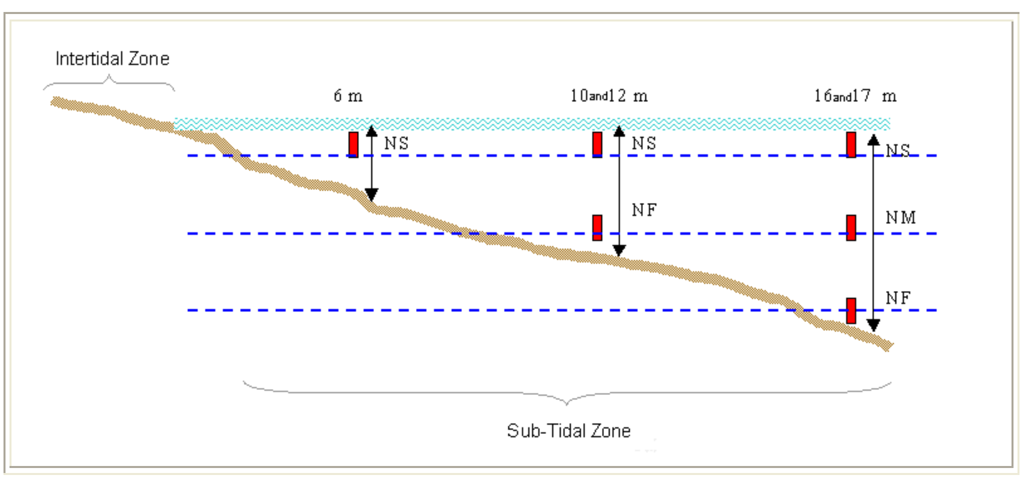


Figure 3-8. Subtidal Sampling Zone Water Column Levels: Surface (NS), Midlevel (NM) and Bottom (NF)

The main parameters, collection methods and analysis utilized during the sampling periods at the intertidal zone in Pampa Melchorita are described in the following Table:

Parameters	Method Of Collection	Method Of Analysis
Benthos	Penchazade Tube of 0.0269 m^2 and sample preserved in Formaline to 7%	Quantitative and Qualitative of species in laboratory
Chlorophyll	Dark Bottle of 500 ml and maintained cold	Standard Methods for the Examination of Water and Wastewater APHA/AWWA/WEF 19^{TH} Ed. 1995.
Temperature	Thermometer KALHSICO	Field record.
pH	PAMPEHA reactive strips	Field record.
Granulometry	Core Tube	ASTMs D422
Substrate Inclination	Water levels	Field record of the slope.
Substrate Penetrability	Penetrability rod.	Field record.
Suspended Solids	250 ml bottles and maintain cold.	Standard Methods for the Examination of Water and Wastewater APHA/AWWA/WEF 19^{TH} Ed. 1995.
Total Phosphorus	300 ml bottles with 1 ml of Sulfuric Acid	Standard Methods for the Examination of Water and Wastewater APHA/AWWA/WEF 19^{TH} Ed. 1995.
Organic Nitrogen	300 ml bottles with 1 ml of Sulfuric Acid	Standard Methods for the Examination of Water and Wastewater APHA/AWWA/WEF 19^{TH} Ed. 1995.

Parameters	Method Of Collection	Method Of Analysis
Total Nitrogen	300 ml bottles with 1 ml of Sulfuric Acid	Standard Methods for the Examination of Water and Wastewater APHA/AWWA/WEF 19TH Ed. 1995.
Pesticides	1 litre bottles and maintain cold	Standard Methods for the Examination of Water and Wastewater APHA/AWWA/WEF 19TH Ed. 1995. The following 10 organic- chlorinated pesticides were analyzed: Lindano, heptacloro, aldrin, deldrin, endrin, endosulfan, metoxicloro, p.p-DDE, p.p-DDD, p.p-DDT.
BOD	1 litre bottles and maintain cold	Standard Methods for the Examination of Water and Wastewater APHA/AWWA/WEF 19TH Ed. 1995.
Parasites	2 L bottles with formaline to 10 %	Standard Methods for the Examination of Water and Wastewater APHA/AWWA/WEF 19TH Ed. 1995.
Total Coliforms	250 ml bottles and maintain cold	Standard Methods for the Examination of Water and Wastewater APHA/AWWA/WEF 19TH Ed. 1995.
Fecal Coliforms	250 ml bottles and maintain cold	Standard Methods for the Examination of Water and Wastewater APHA/AWWA/WEF 19TH Ed. 1995.
Birds and Mammals	Transect survey account	Quantitative of species in the field.

The main parameters, collection methods and analysis utilized during the sampling periods at the subtidal zone in Pampa Melchorita are described in the following Table:

Parameters	Method Of Collection	Method Of Analysis
Benthos	Van-Veen Dredge of 0.025 m^2 and 2 quadrats of 1 m^2 . Samples are 0.5 and 1.0 ml filtered.	Quantitative and Qualitative of species at laboratory.
Chlorophyll	Dark glass of 500 ml maintain cold.	Standard Methods for the Examination of Water and Wastewater APHA/AWWA/WEF 19^{TH} Ed. 1995.
Primary Productivity-Phytoplankton	Niskin Bottle (at 3 water levels: surficial, medium and bottom)	Quantitative and Qualitative of species at laboratory.
Secondary Productivity-Zooplankton	Net of 75 microns. Simples are preserve in formaline at 7% (1 water level: Superficial)	Quantitative and Qualitative of species at laboratory.
Temperature	Sub-aquatic Thermometer (3 water levels: superficial, medium and bottom)	Field record.
pH	PAMPEHA reactive strips	Field record
Dissolved Oxygen	From water samples at 3 levels: superficial, medium and bottom	Modified Method of WINKLER by CARRIT and CARPENTER 1966.
Salinity	Niskin Bottle (3 water levels: superficial, medium and bottom)	Meter brand KALHSICO RS 1
Sulfates	500 ml bottles and maintain cold	Standard Methods for the Examination of Water and Wastewater APHA/AWWA/WEF 19^{TH} Ed. 1995.
Marine Circulation	Drifters at 2 water levels: surface and bottom	Currents measure by Lagrange Method
Suspended Solids	250 ml bottles and maintain cold	Standard Methods for the Examination of Water and Wastewater APHA/AWWA/WEF 19^{TH} Ed.

Parameters	Method Of Collection	Method Of Analysis
		1995.
Total Phosphorus	300 ml bottles with 1 ml of Sulfuric Acid.	Standard Methods for the Examination of Water and Wastewater APHA/AWWA/WEF 19TH Ed. 1995.
Organic Nitrogen	300 ml bottles with 1 ml of Sulfuric Acid.	Standard Methods for the Examination of Water and Wastewater APHA/AWWA/WEF 19TH Ed. 1995.
Total Nitrogen	300 ml bottles with 1 ml of Sulfuric Acid.	Standard Methods for the Examination of Water and Wastewater APHA/AWWA/WEF 19TH Ed. 1995.
Pesticides	1 litre bottles and preserve cold	Standard Methods for the Examination of Water and Wastewater APHA/AWWA/WEF 19TH Ed. 1995.
BOD	1 litre bottles and preserve cold	Standard Methods for the Examination of Water and Wastewater APHA/AWWA/WEF 19TH Ed. 1995.
Parasites	2 L bottles preserve in formaline to 10 %	Standard Methods for the Examination of Water and Wastewater APHA/AWWA/WEF 19TH Ed. 1995.
Total Coliforms	250 ml bottles maintain cold	Standard Methods for the Examination of Water and Wastewater APHA/AWWA/WEF 19TH Ed. 1995.
Fecal Coliforms	250 ml bottles maintain cold	Standard Methods for the Examination of Water and Wastewater APHA/AWWA/WEF 19TH Ed. 1995.
Fishes	Surveys with artisanal fisherman and direct fishing with bottom lines and nets	Quantitative and qualitative of species in the field.

3.2.2 Results of Autumn and Spring Marine Samplings

3.2.2.1 Intertidal Zone

Physical, Chemical and Microbiological Parameters

The results of the physical, chemical and microbiological parameters analyzed during the autumn sampling period are shown at Tables 3-6, 3-7 and 3-8. The results of the spring sampling period are shown in Tables 3-9, 3-10 and 3-11.

The following Table summarizes the parameters analyzed in both sampling periods:

Parameter	Autumn	Spring
Physical and Chemical Parameters of Water Quality		
PH	7.0 y 7.5	7.0 y 7.7
Hardness		6581 mg/L
Total Suspended Solids	9 mg/L	17 mg/L
Total Nitrogen	0.10 mg/L	0.29 mg/L
Organic Nitrogen	0.10 mg/L	0.2 mg/L
Total Phosphorus	0.05 mg/L	0.13 mg/L
Chlorophyll	0.031 mg/L	0.005 mg/L
Granulometric Analysis of Sediments	At saturation zone 25 m on shore; transect 2 shows fine particles (Sieve No. 10), transect 7 shows particles of greater size (Sieve No. 4).	At saturation zone 40 m on shore; transect 1 shows fine particles (Sieve No. 40), transect 8 shows particles less fine (Sieve No. 40)
Pesticide Analysis	Below detection limit of method	Below detection limit of method. Observed slightly increase on the value of the pesticide ALDRIN.
Micro-Biological and Pollution Parameters		
Fecales and Total Coliforms	<2 NMP/100 ml	<2 NMP/100 ml
Parasites Analysis	Free of parasites	Free of parasites.
BOD_5	1.00 mg/L	1.00 mg/L

Biological Aspects

- **Benthic Community in Autumn**

A total of 16 taxonomic units were identified, among mollusks, crustaceans, nemerteans, polychaetes and other groups of minor invertebrates typical of a sandy beach with the groups of highest abundance being the polychaetes and crustaceans. The most abundant species within the group of polychaetes were *Hemipodus triannulatus* and *Glicera* sp., which were found in all of the sampling zones. In the group of crustaceans the most important species found were *Excirollana brasilensis* and *Emerita analoga*.

The diversity of macro benthos at the beach zone ranged from 0.12 to 1.98 bits/individual in the area. These values are representative of zones with a low diversity of species. A typical characteristic of this type of ecosystem (see Figure 3-9).

The highest value of diversity was found at the saturation zone of transect 4; on the other transects, the highest values occurred at the retention and the upwelling zone.

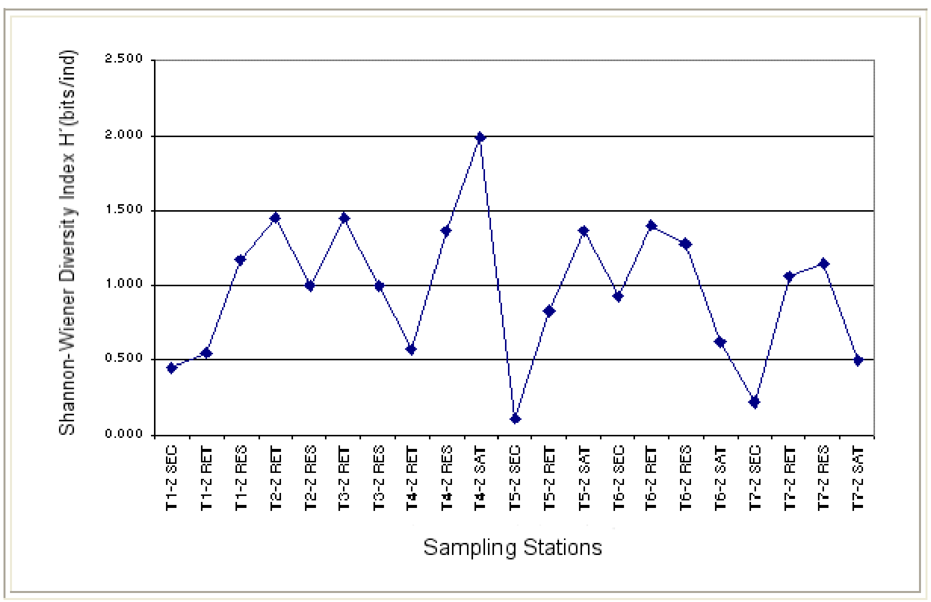


Figure 3-9. Variations of the Diversity Index (H´) of the Macro-Benthos at the Sandy Beach versus results on each Sampling Station. Pampa Melchorita, Autumn 2002.

The dendogram to 50% of similarity shows the existence of six (6) groups defined by the inclination of the beach (slope), strong hydrodynamics of the site (at saturation and upwelling zone) and the size of the particle sediment as it was visually characterized (see Figure 3-10).

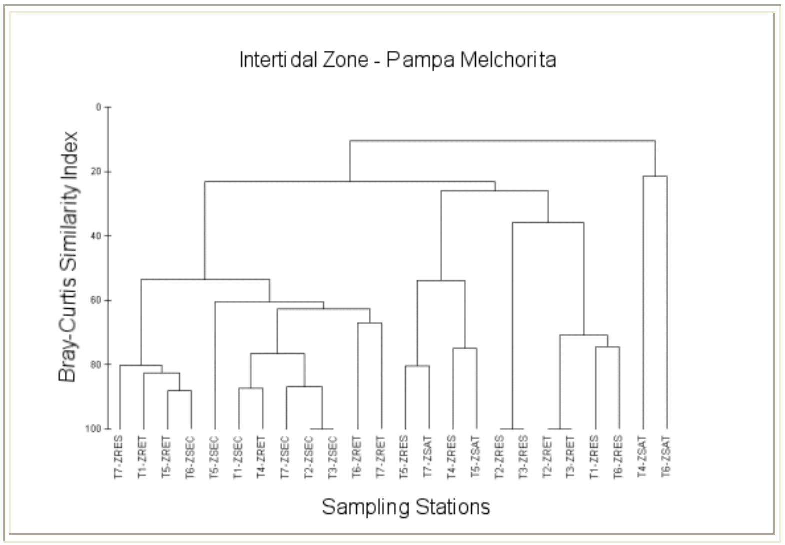


Figure 3-10. Cluster Analysis of the Macro Benthos of the Sandy Beach. Playa Melchorita. Autumn 2002.

The composition of the macro-benthos at the sandy beach of Pampa Melchorita during the autumn sampling period is shown in Table 3-12.

Regarding the thixotropy, understanding this as the penetrability of the sand with respect to the size of a particle and the water saturation in the sediment, a direct relationship with the substrate inclination was found, meaning that at greater inclination there was greater thixotropy (see Figure 3-11).

At transect T3 the slope increases relative to the distance from the shore; it is then probably that the inter-tidal zone is covered by the sea according to the tide system.

At transects T1 and T2 the slope was observed inverse to the thixotropy. The sand grain was slightly coarse and completely wet impeding penetration of measurement rod in the substrate, which is represented by the values found.

In the stations located to the north of transect T3 a more uniform slope along the shore was observed, except at transect T4.

These factors, such as greater thixotropy and inclination, are related to the low diversity of the zone, due to the coarse size of the sediment particle and a greater activity of waves, these are unfavorable conditions for the settling of typical species (See Figure 3-12 and Figure 3-13). As a conclusion from this first sampling period, the low diversity of species found is due to typical factors of the environment and not to human related activities.

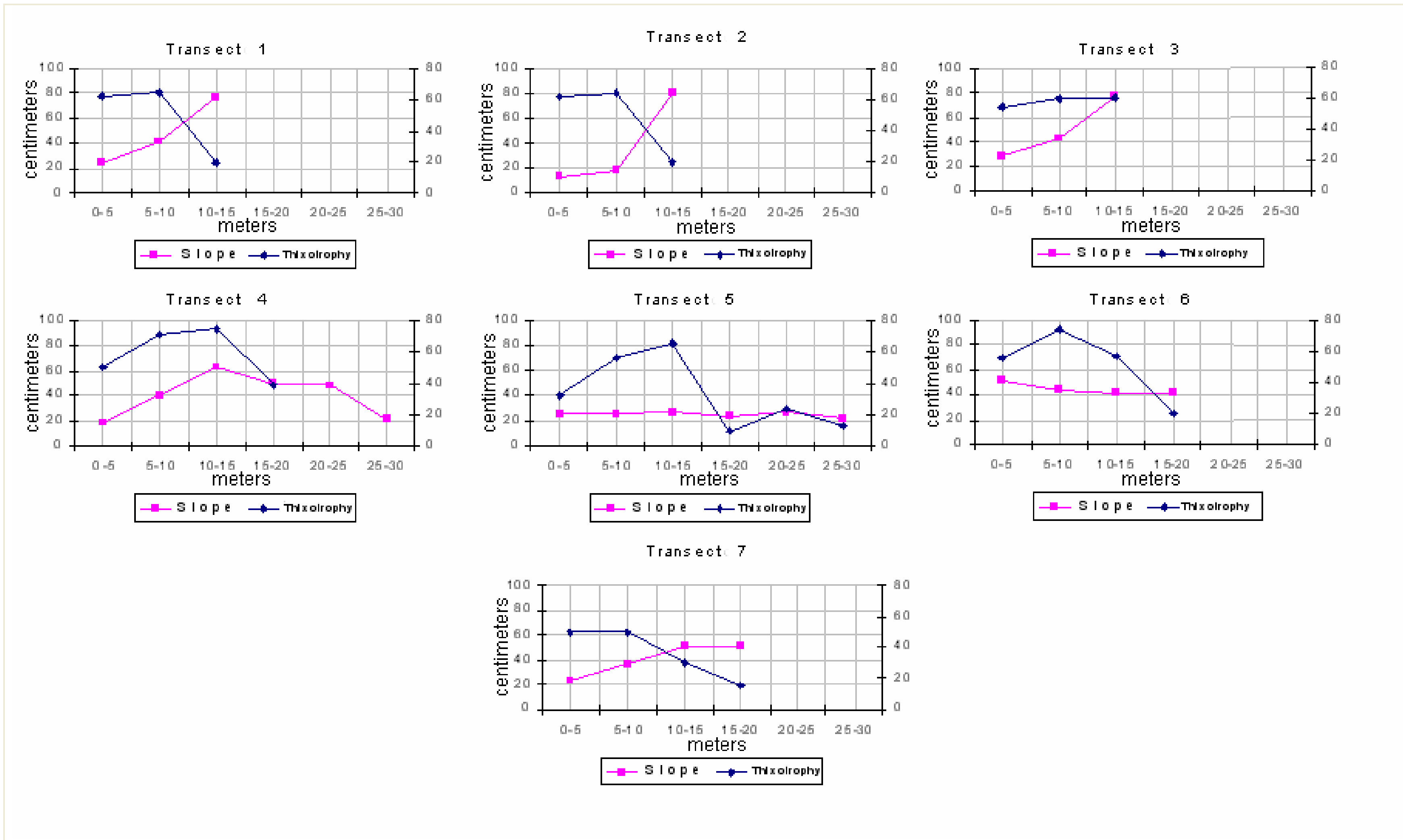


Figure 3-11. Variations of the Slope and Thixotropy by Transects. Playa Melchorita, Autumn 2002

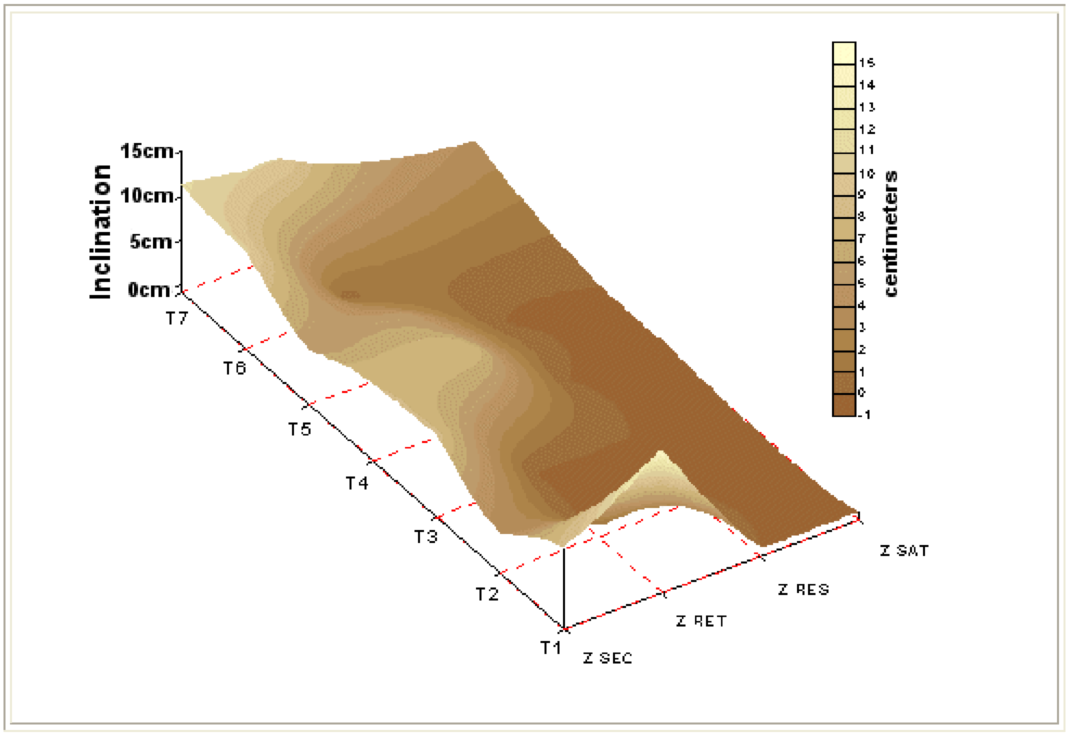


Figure 3-12. Distribution of the Inclination Values Recorded in the Sampling Transects. Playa Melchorita, Autumn 2002.

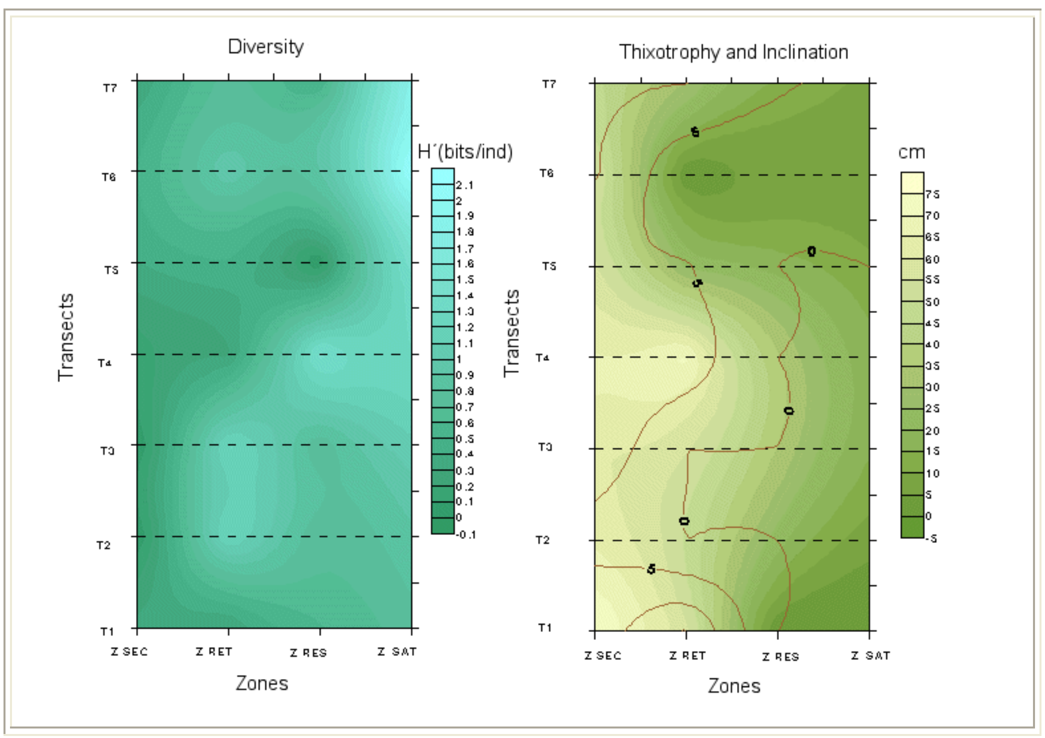


Figure 3-13. Diversity (bits/individuals), Thixotropy and Inclination (cm). Playa Melchorita, Autumn 2002

- **Benthic Community in Spring**

A total of 18 taxonomic units were identified during this sampling period, including the following groups: plathelminthes, nematodes, polychaetes, oligochaetes, insects, crustaceans and mollusks. The group of largest abundance was polichaetes and plathelminthes (turbellarians). The most abundant species within the polychaetes group was *Glicera sp*. Among the plathelminthes, the so called “sea planarian” was found. These two species were found along the study area. The diversity in this beach zone ranged from 0.0 (in this transect only one specie was found) to 1.76 bits/individuals in the area. These values are representative of zones of low diversity of species, a characteristic of this type of ecosystem.

The diversity of macro benthos index values are lower than those reported in June (the autumn sampling period) due to the presence of a high tide which produce habitat alterations and changes in the structure of typical communities of sandy beaches. The observed decrease of diversity index may be associated with either the so called “El Niño” effect, or may be a typical characteristic of the Playa Melchorita.

The greatest diversity index was observed at the saturation zone of transect T8 (1.76 bits/individuals). The other two zones with a higher diversity index values were at transect T7-retention zone and transect T4-saturation zone (See Figure 3-14).

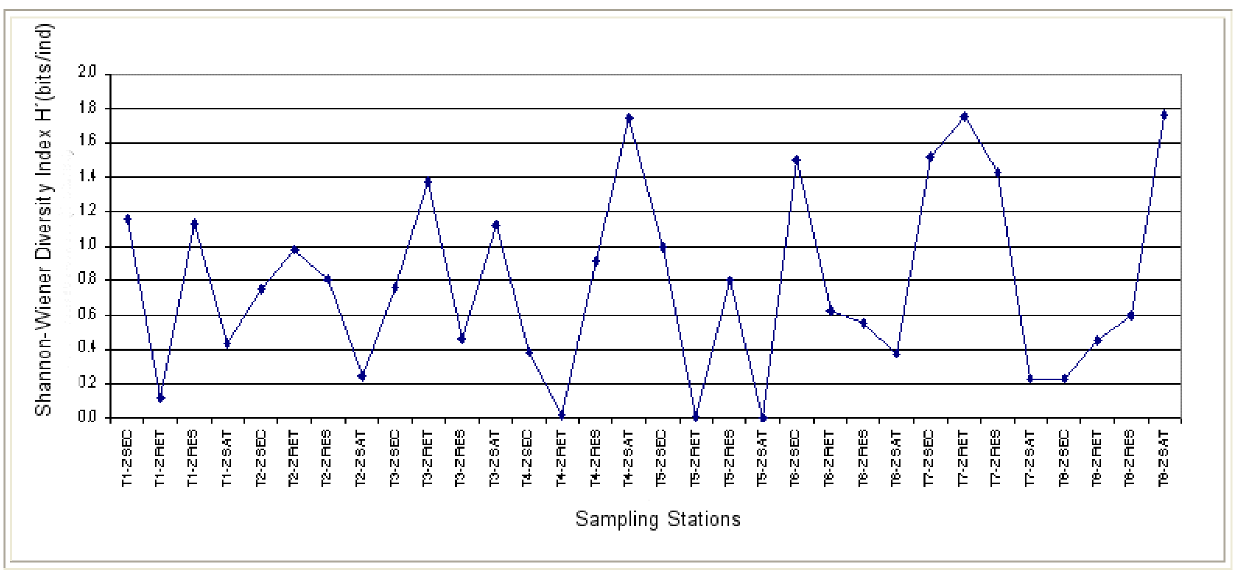


Figure 3-14. Variations of the Diversity Index (H’) for the Macro-Benthos at each Sampling Station. Pampa Melchorita, Spring 2002.

During the June sampling event, the highest diversity index was reported at Transect T4-saturation zone (1.98 bits/individual). At transect T7-saturation zone (re-labled as transect T8-saturation zone after inserting a new transect line) presented low diversity index values.

At transect T5-drying zone a uniform composition by species was observed.

The dendogram at 50% of similarity index presents the existence of eight (8) groupings defined by the inclination of the beach (slope), the strong hydrodynamics conditions at the study area (in the saturation and upwelling zone) and the size of the sediment particle visually characterized. There is not a very high variability regarding abundance and number of species at the drying, retention, upwelling and saturation zones among the different transects, except at transect T1-drying zone, transect T6-saturation zone and transect T8-saturation zone (see Figure 3-15).

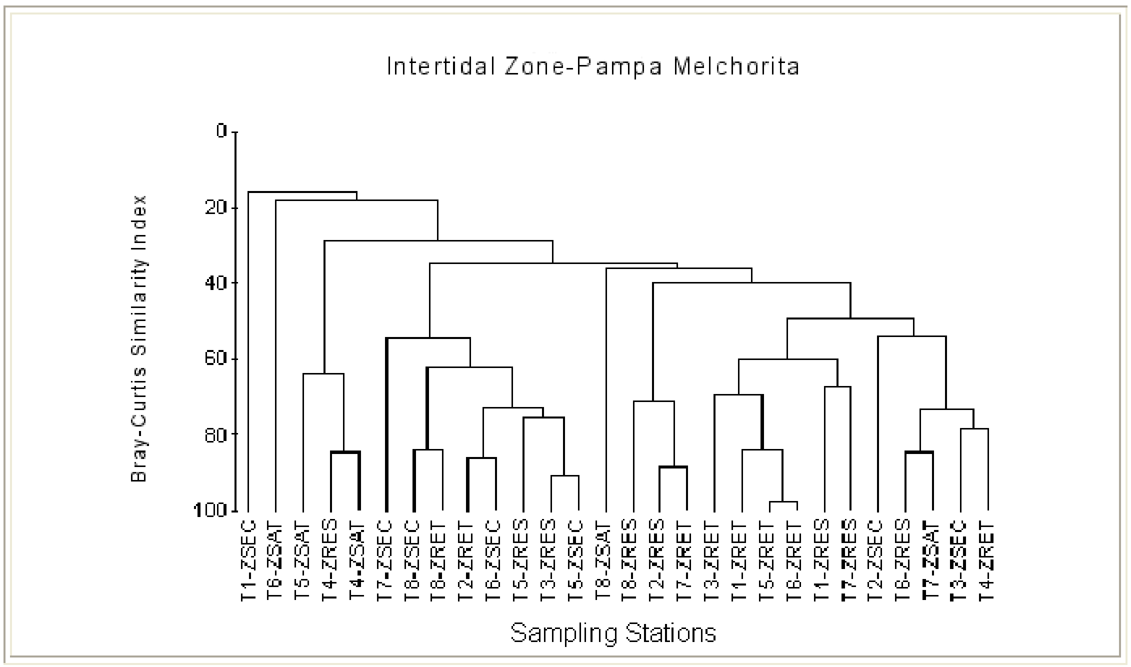


Figure 3-15. Cluster Analysis by Sampling Station of the Macro-Benthos of Sandy Beach. Playa Melchorita, Spring 2002.

The composition of the macro-benthos found at the sandy beach during the spring sampling period is shown in Table 3-13.

No relationship was noted between the thixotropy and the inclination of the substrate. The shoreline presented a non-distinct inclination, with depressions and abrupt elevations, these alterations on the surface were due to the action of strong waves observed during the sampling period and previous days. The variations of diversity and thixotropy by transect lines is shown in Figure 3-16.

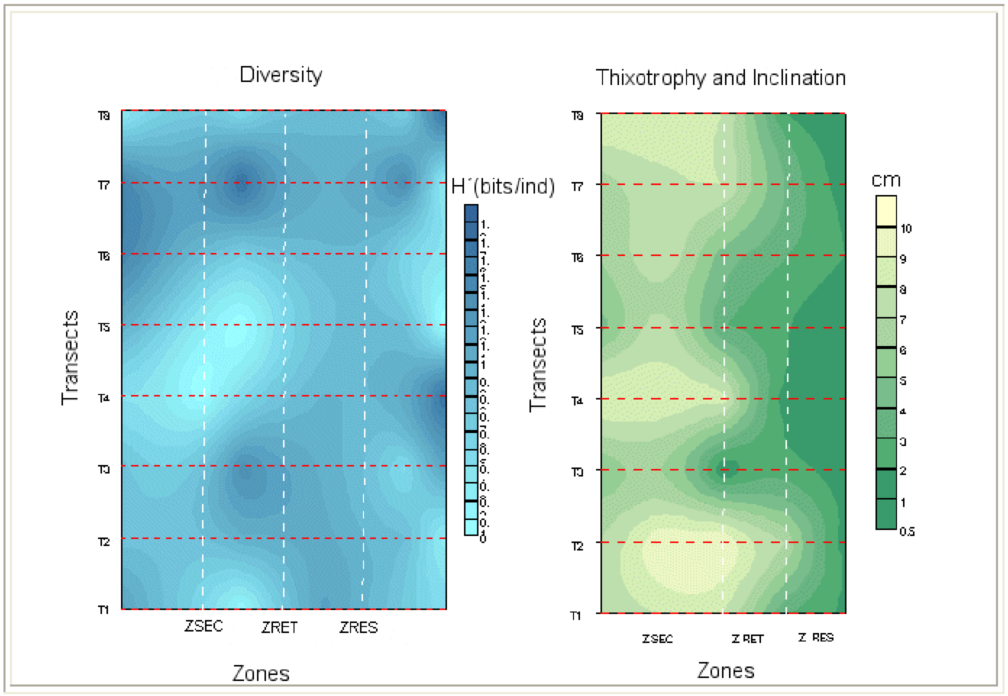


Figure 3-16. Diversity (bits/individual) and Thixotropy (cm). Playa Melchorita, Spring 2002

Foci of greater diversity are observed at the drying zone of transect lines T6 and T7; the retention zone of transects T3 and T7, and at the saturation zone of transects T4, T7 and T8 as previously mentioned.

Regarding thixotropy, the distribution observed is of the typical zonation at a sandy beach, showing that the lower the thixotropy the greater the diversity, since the highest sediment compaction allows for the settling of a greater number of organisms, as well as the construction of shelters by these organisms. It is necessary to note that this area itself is not greatly diverse and the decrease in thixotropy will favored certain species.

A more homogenous distribution in thixotropy was observed from the upwelling zone. This same pattern was observed during the June sampling.

No relationship to inclination was established, since there is no uniformity in the slope distribution was observed. The higher thixotropy and the activity produced by the breaking waves do not allow that a greater diversity succeed in the drying and retention zones.

The low diversity of species found during this sampling period was due to typical environmental factors and not related human activities.

- **Other Groups Observed During Shoreline Sampling**

During the Autumn sampling event the number of individual "cangrejo carretero" (shore crabs) *Ocypode* sp. consisted of an average of 19 individuals in 5 m^2. This is one of the largest populations present along the study area, generally found at the drying zone, and in few occasions in the retention zone, together with the populations of *Emerita analoga and Ocypode sp*. Both species serve as a food source to the rodents present in the hillsides. These species are a representative specie of the sandy beaches with low human activity, typical of the central coast of Peru and are an intermediary species of the trophic chain. Therefore, it is important to analyze their populations and verify the increase or decrease both spatially and seasonally.

In comparison with the autumn sampling event, a greater number of "cangrejo carretero" (shore crabs) *Ocypode sp* were observed with an average of 23 individuals in 5 m^2 during the spring sampling. These crabs were not found in zones where greater concentration of birds were observed.

3.2.2.2 Subtidal Zone

Hydrographic, Physical-Chemical and Microbiological Parameters.

Data on the hydrographic, physical-chemical and microbiological parameters registered during the autumn sampling period are shown at Tables 3-6, 3-7, 3-8 and 3-14. Figures 3-17, 3-18, 3-19 and 3-20 present the results of temperatures, salinity, dissolved oxygen and current direction and speed of the water at the surface and at the sea bottom.

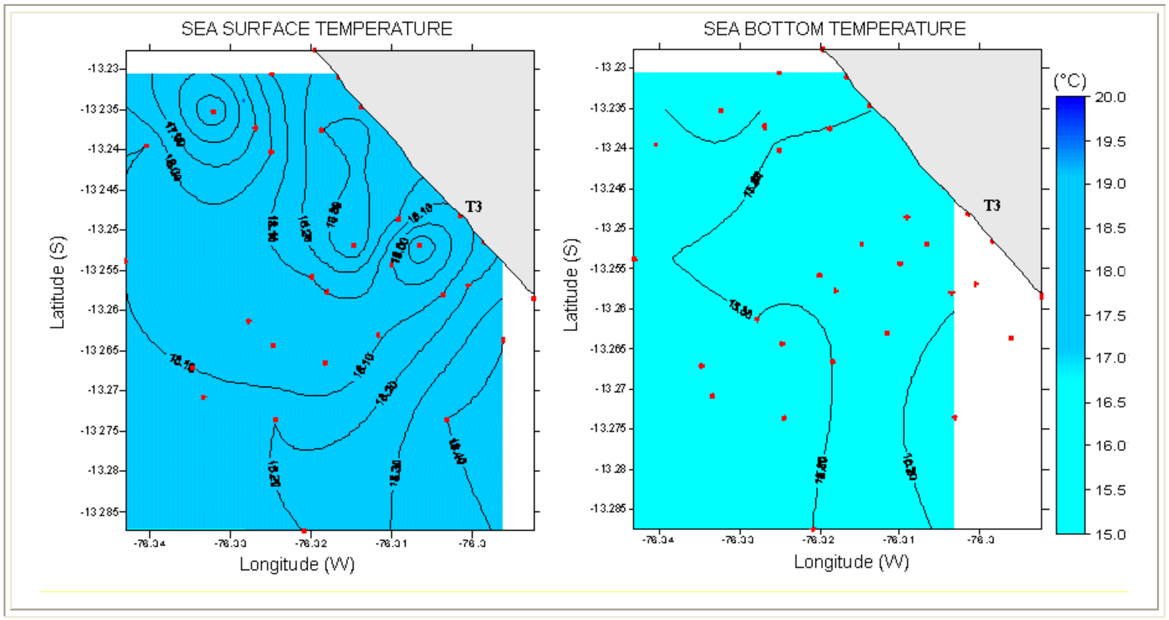


Figure 3-17. Distribution of the Temperature in the Sea Surface and the Sea Bottom (°C)

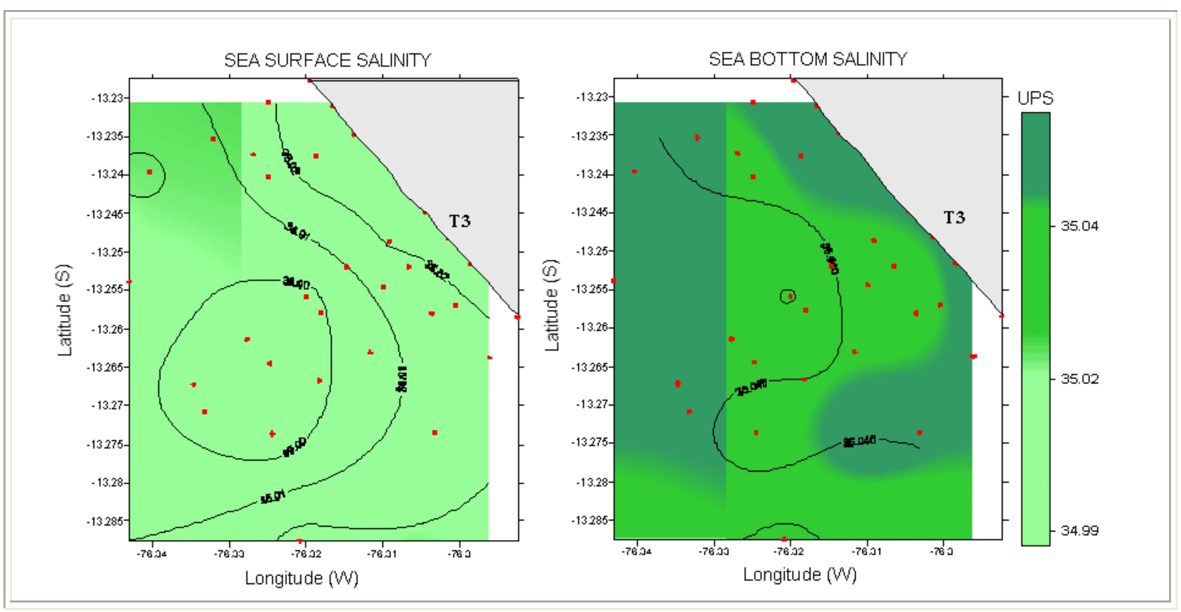


Figure 3-18. Distribution of Salinity of the Sea surface and the Sea Bottom (ups)

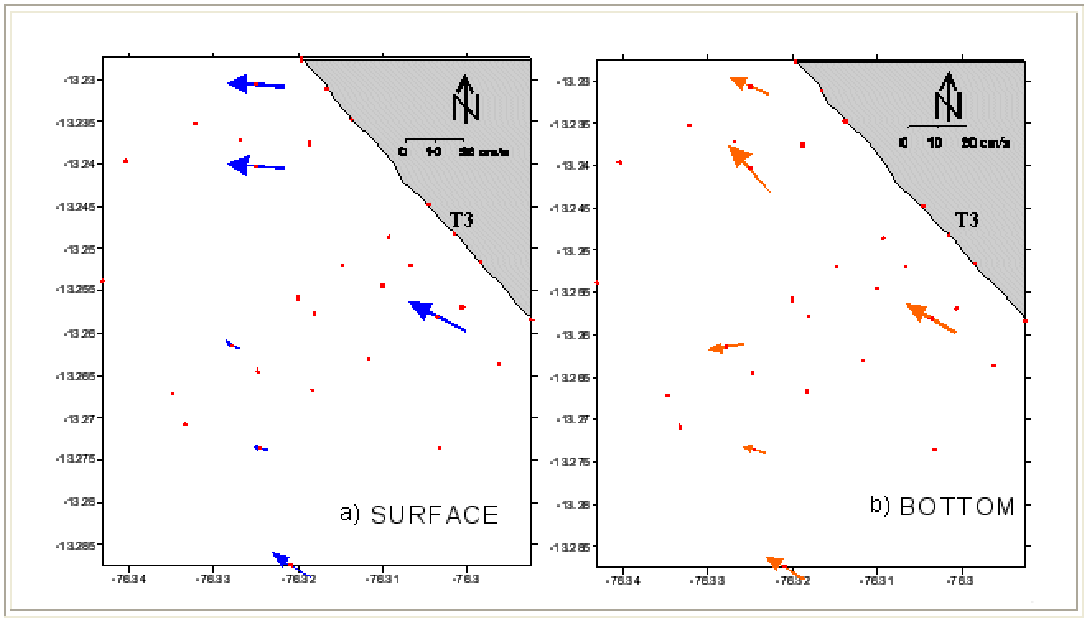


Figure 3-19. Distribution of the Direction and Speed of Sea Currents at Surface and Sea Bottom (cm/s)

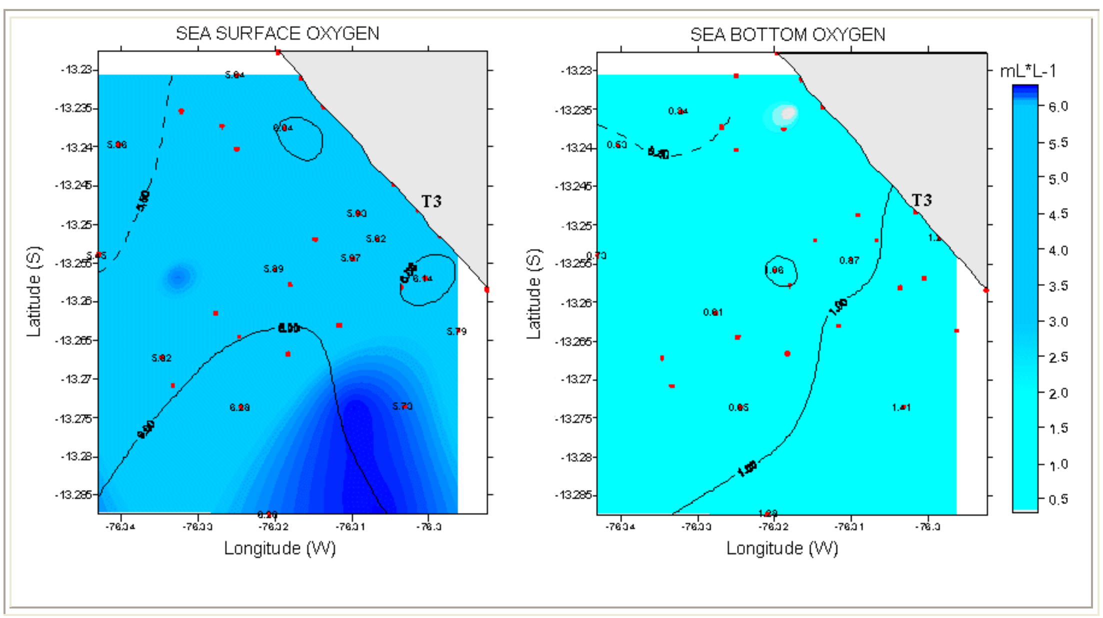


Figure 3-20. Distribution of the Dissolved Oxygen Content in the Sea Surface and the Sea Bottom (ml*l-1)

Data on the hydrographic, physical-chemical and microbiological parameters registered during the spring sampling period are shown in Tables 3-9, 3-10, 3-11 and 3-15. Figures 3-21, 3-22, 3-23 and 3-24 present the results of temperatures, salinity, dissolved oxygen and current direction and speed at the water surface and at the sea bottom.

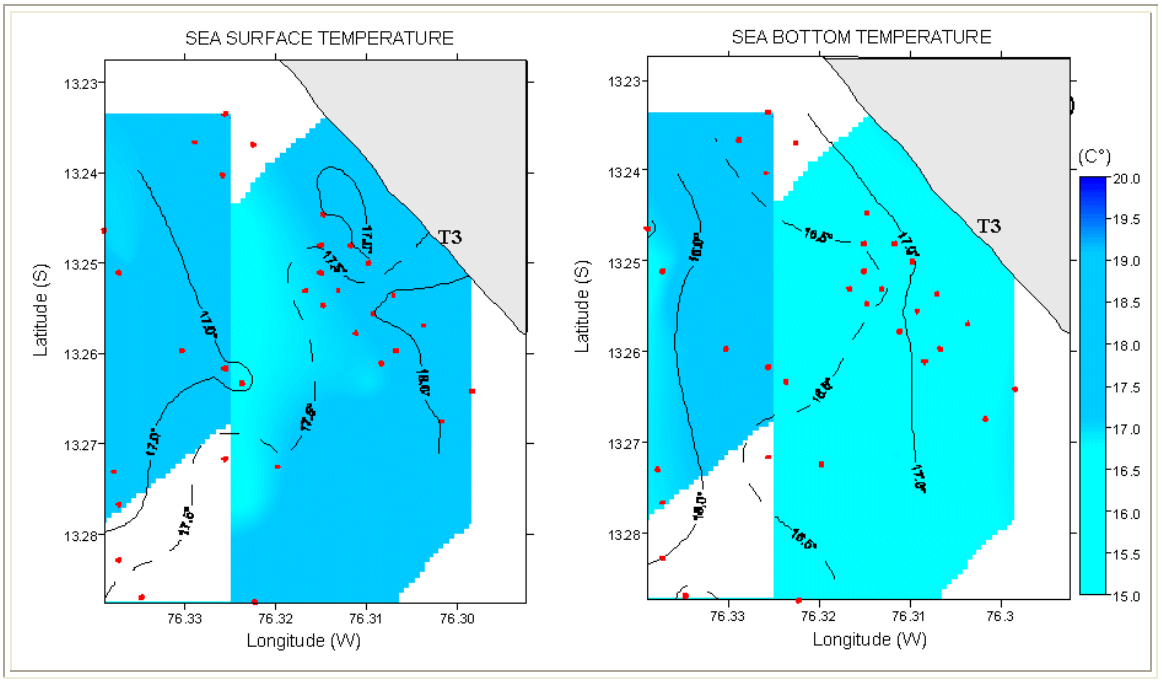


Figure 3-21. Distribution of Temperature in the Sea Surface and the Sea Bottom (°C)

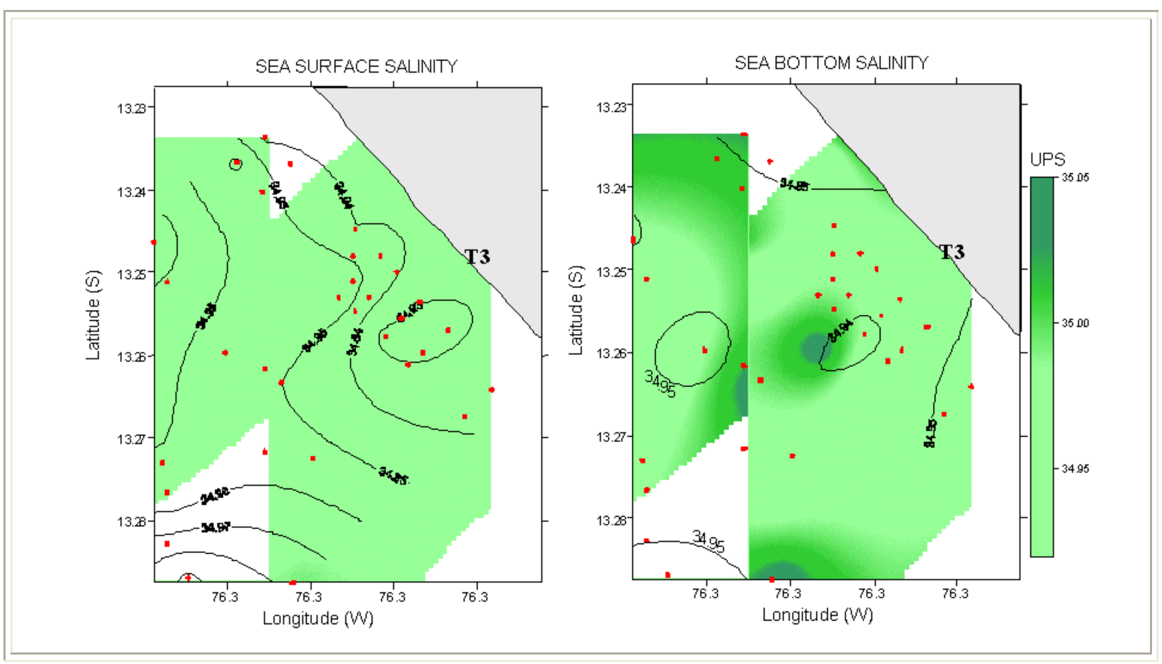


Figure 3-22. Distribution of the Salinity (ups) of the Sea Surface and the Sea Bottom

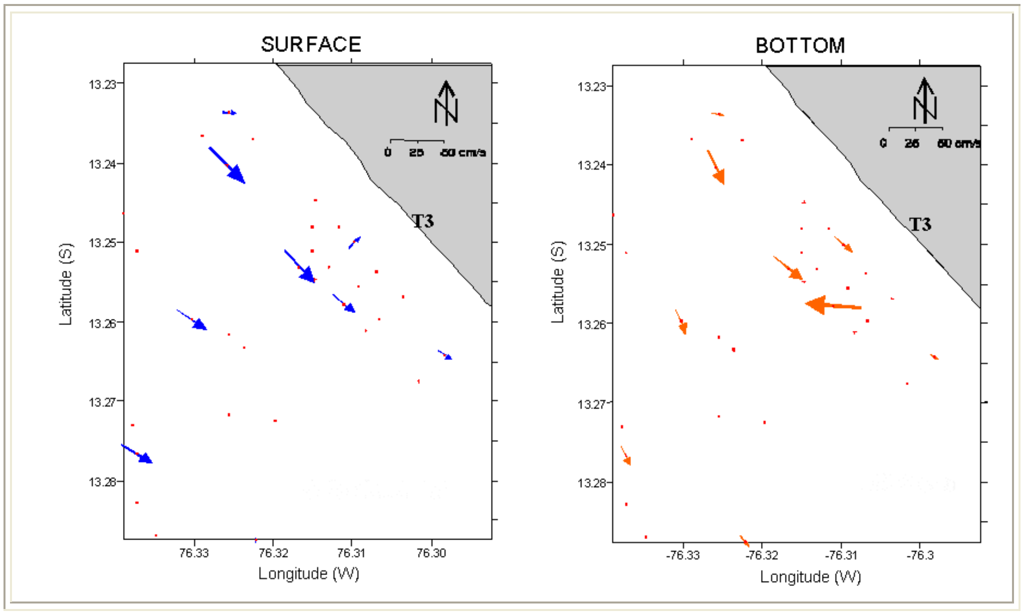


Figure 3-23. Distribution of the Direction and Speed of the Sea Current at Surface and Sea Bed (cm/s)

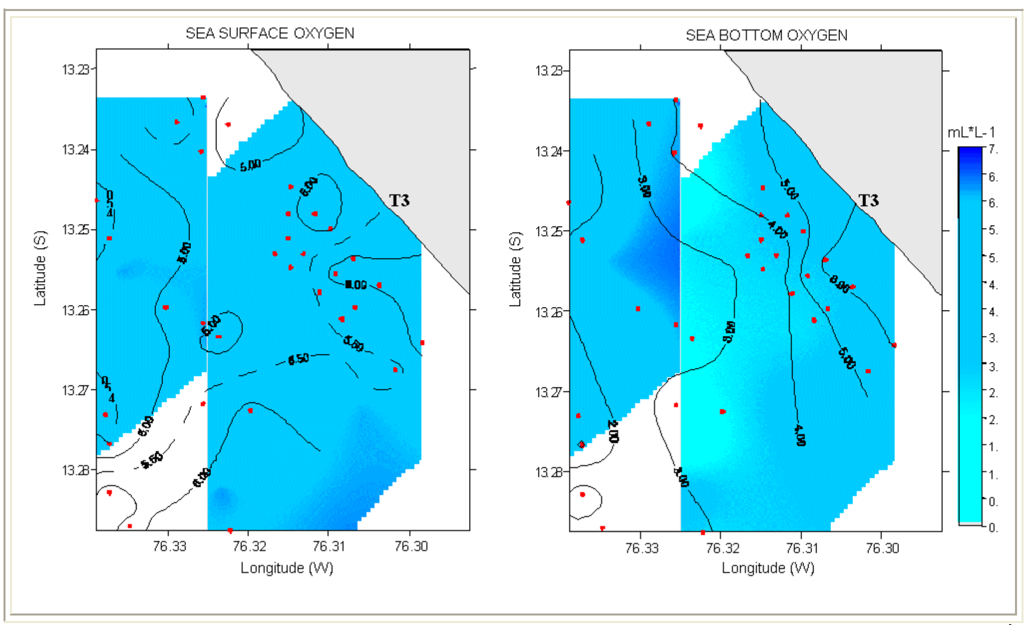


Figure 3-24. Distribution of Dissolved Oxygen in the Surface Sea and the Sea Bed ($ml*l^{-1}$)

A summary of the hydrographic, physical-chemical and microbiological parameters registered during both sampling periods is shown at the following table:

Parameter	Autumn	Spring
Hydrographic and Marine Circulation Parameters		
Superficial Temperature	17.6°C to 18.4 °C	16.6 °C to 18.4 °C
Bottom Temperature	15.6°C to 16.5 °C	16 °C to 16.5 °C
Superficial Salinity	34,993 to 35,026 ups	34,927 to 34,992 ups
Bottom Salinity	35,027 to 35,047 ups	34,938 to 34,955 ups
Superficial Marine Circulation	4.86 to 20.42 cm/s (NW direction)	22.3 cm/s (SE direction)
Bottom Marine Circulation	4.19 to 15.69 cm/s (NW direction)	21.5 cm/s (SE direction)
Physical and Chemical Parameters of Water Quality		
Superficial Dissolved Oxygen	5.45 $ml*l^{-1}$	4.30 to 6.26 $ml*l^{-1}$
Bottom Dissolved Oxygen	0.34 $ml*l^{-1}$ to 1.41 $ml*l^{-1}$	0.88 to 6.11 $ml*l^{-1}$
pH	7.2	7.3
Hardness		6561 mg/l
Total Suspended Solids	5 mg/l	<5 mg/l
Total Nitrogen	0.61 mg/l	0.34 mg/l
Organic Nitrogen	0.60 mg/l	0.3 mg/l
Total Phosphorus	0.10 mg/l	0.06 mg/l
Sulfates	1710 mg/l (station T2-17m)	1966.9 mg/l (station T2-17m)
	2005 mg/l (station T4-17m)	2032.5 mg/l (station T4-17m)
Chlorophyll	<0.001 mg/l	0.005 mg/l
Pesticides	Below methods detection limit	Below methods detection limit
Micro-Biological and Pollution Parameters		
Total and Fecal Coliforms	<2 NMP/100 ml	<2 NMP/100 ml
Parasites	Free of Parasites	Free of Parasites
BOD_5	2.00 mg/l	2.00 mg/l

Biological Aspects

- **Plankton Community in Autumn**

Primary Productivity (Phytoplankton)

To provide an overview of the evolution of marine productivity at the study area, a colorametric analysis of the ocean using satellite images was performed. The presence of chlorophyll type "A" generated by photosynthetic unicellular microorganisms, acts as an indicator of primary productivity producing a scale of colors ranging from the extremes of dark green (representing coastal waters from the Humboldt Current) to light blue (representing ocean waters with low productivity).

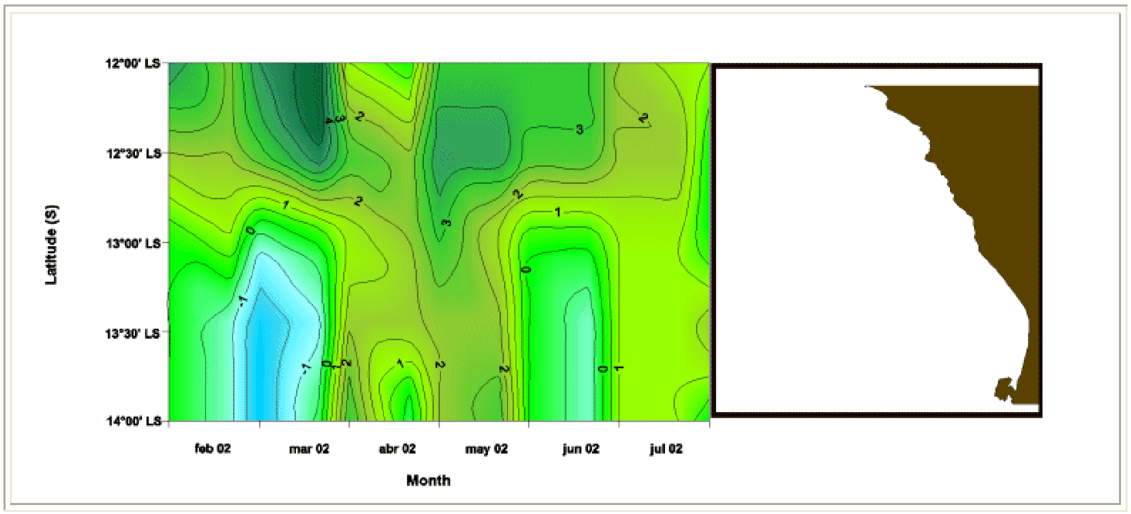


Figure 3-25. Chlorophyll "A" Monthly Distribution between 50 to 100 miles from the Shoreline. January 2002 - July 2002 (between 12° SL and 14° SL).

Figure 3-25 depicts a seasonal marine productivity, with maximum values of chlorophyll between the months of February to March oriented towards the northern area (the area of coastal influence) and decreasing in June and July. The southern coastal area shows different seasonal features due to the influence of the dynamic sea conditions, where minimum productivity values are observed during the summer months when ocean waters approach the coast. The dynamic of productivity for the area north of 13°LS seems to be influenced by the Humboldt Current (Thomas 2001) and shows a decrease in the nutrient concentration during the winter months when cloud coverage increases, impeding photosynthesis and unicellular algae proliferation in the ocean surface, and increases the nutrient concentration during the Autumn months (April to June), when the effect of cloud coverage is reduced.

During the autumn sampling, a total of 91 phytoplankton species have been identified which comprise 44 diatoms, 41 dinoflagellates, 2 silicoflagellates and 4 phytoflagellates. (See Table 3-16).

In Playa Melchorita, the primary productivity of plankton is represented by the number of cells that are within the average values which correspond to the phase of the annual cycle, that is to say, the end of the growth period. There was a much greater abundance of plankton at the water surface where densities ranged from 15,006 to 46,819 cells/50 ml at stations T3-6 and T5-6, respectively. At 10 m of depth the density range is from 1,077 cells/50 ml at station T5-17 and 11,961 cells/50 ml at station T7-17. At 17 m of depth the density ranges from 1,468 cells/50 ml at station T7-17 to 3,168 cells/50 ml at station T1-17.

Analyzing data from the water column, or total quantity at each sampling station, the greatest densities were recorded at the bottom of each sampling station at 17 m of depth such as T3-17, T5-17 and T7-17 with 400,624, 317,842 and 358,960 $*10^4$ cells/m^2, respectively, and the lowest densities were recorded at the more coastal and surficial stations such as T3-6 and T7-6 (at 6 m of depth) with 30,012 and 37,312 $*10^4$ cells/m^2, respectively.

In general, the dominant species, group numerically was the diatoms, followed by the phytoflagellates, except near the surface where the dominance was less noted, with phytoflagellates being the most abundant species (40%), followed by diatoms (38%) and the dinoflagellates (21%). However, considering the available biomass as food for the bigger organisms, the phytoflagellates represents only a small amount of biomass with respect to the diatoms. At greater depth, the phytoflagellates and dinoflagellates decrease and the silicoflagellates progressively increase, being dominant the diatoms which represents more than 50% of the total density. In the entire study area the dinoflagellate of genus *Gymnodinium sp,* was the predominant organism that produces red tides, a phenomenon that was observed during the baseline sampling. Red Tide was related to temperatures of 17 to 18 ºC.

The most important species were the diatoms: Chaetoceros didymus, Guinardia delicatula, Skeletonema costatum, Leptocylindrus danicus, Ch. debilis and Cilyndrotheca closterium; the Dinoflagellates: Gymnodinium sp, Prorocentrum gracile and Ceratium furca; the silicoflagellates: Dictyocha fibula and mainly the group of phytoflagellates, which due to their small size are very difficult to identify.

The diatom *Thalassiothrix longissima* (a common specie in the ocean) was frequently found, but in very low densities.

An important group within the micro-zooplankton was the ciliates, especially *Strombidium conicum and S. conicoides* which are common organisms in this phase of the annual cycle.

Table 3-17 shows the composition of ciliates and zooplankton found jointly with the samples of phytoplankton. Such species are not considered in the diversity analysis of the phytoplankton, since they represent the accompanying fauna.

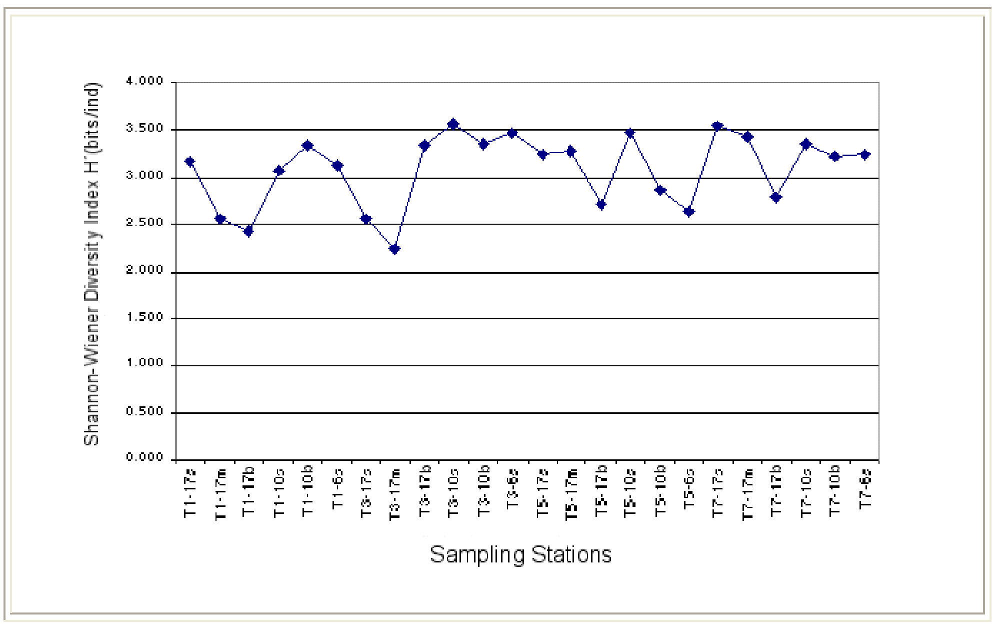


Figure 3-26. Variations in the Phytoplankton Diversity Index (H') by Sampling Point. Pampa Melchorita, Autumn 2002

Figure 3-26 shows T1 phytoplankton diversity values ranged from 2.3 to 3,6 bits/individual over the study area.

At transect T3 (the zone where the trestle will be constructed) the highest and most similar values of diversity index were found, regardless of the depth of the sample. To the north and south of transect T3 the diversity was very variable.

During the field work schools of fish were observed at transects T3 and T5, which were more evident by the presence of dolphins and birds that were in pursuit of these schools of fish.

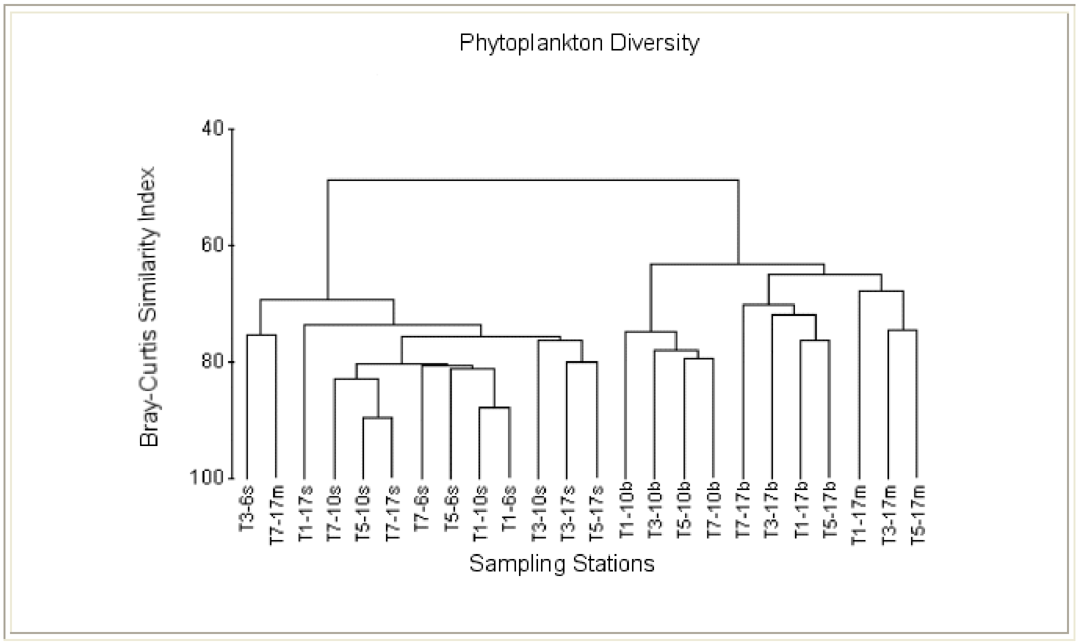


Figure 3-27. Cluster Aanalysis of Phytoplankton by Sampling Station. Pampa Melchorita, Autumn 2002.

Figure 3-27 shows a phytoplankton diversity grouping analysis by sampling station. Using the Bray-Curtiss similarity index at 60%, 2 groups are noted, the first group is formed by the phytoplankton samples obtained at 3 m of depth (except T7-17m), and the second group by those samples obtained from10 m and 17 m of depth. The analysis indicates the presence of two phytoplankton communities, which are differentiated by their depth within the water column.

Secondary Productivity (Zooplankton)

A total of 11 groups were determined within the zooplankton, among them: medusas, pelecypods, polychaetes, copepods, cirripedes, isopods, misidaceos, amphidods, decapods, brachiopods and apendicularias. The most frequent and abundant specie was the copepod *Acartia tonsa* with concentrations between 22 Individuals/sample and 1250 individuals/sample.

The copepod *Centropages brachiatus*, an indicator of the cold coastal waters, was recorded with a value of 3 individuals /sample (See Table 3-18).

Figure 3-28 shows the variation of the levels of zooplankton diversity using thte Shannon-Weaver Diversity Index. The diversity values ranged from 0.1 and 1.3 bits/individuals. The highest value of diversity index corresponds to transect T3. At transects T1 and T6 lower values of diversity index were observed.

As in the case of phytoplankton, the highest diversity index of Zooplankton was found between transects T3 and T5.

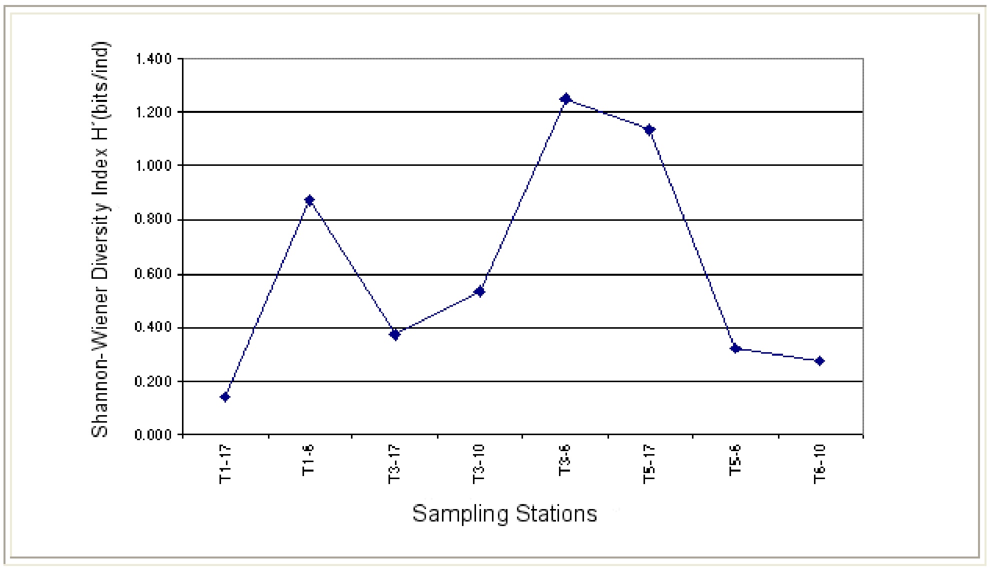


Figure 3-28. Variations of the Diversity Index (H´) of Zooplankton by Sampling Station. Pampa Melchorita, Autumn 2002

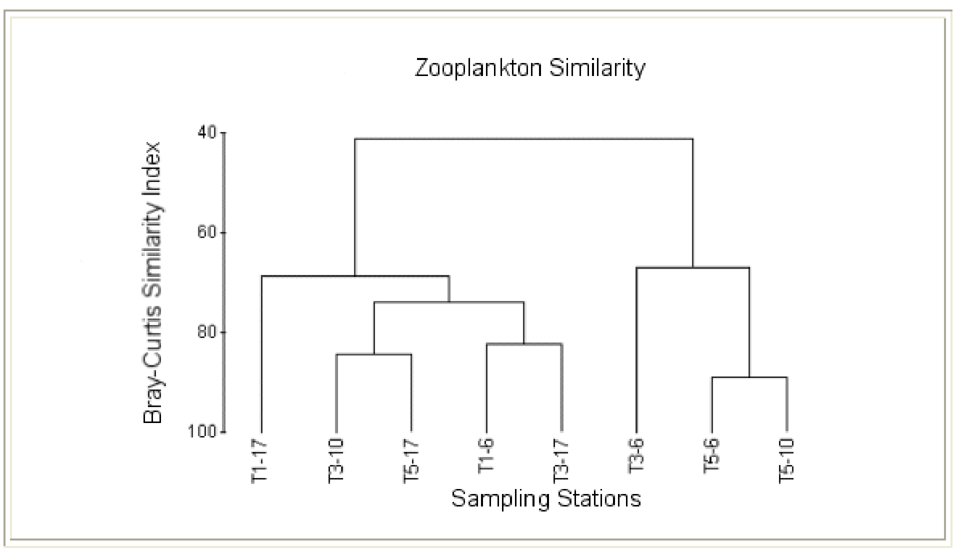


Figure 3-29. Cluster Analysis of Zooplankton by Sampling Station. Pampa Melchorita, June 22 – 23, 2002.

The corresponding grouping analysis as shown in Figure 3-29 indicated two groups with a similarity index of 60%. The first group was found at those sampling stations where the greatest number of individuals of the specie *Acartia tonsa* was obtained and where the greatest quantity of individuals by species was reported. The second group represents those stations with lesser quantity of individuals corresponding species as compared to the total of species.

Regarding ichthyoplankton, eggs of "anchovy" *Engraulis ringens* and larvae of "silverside" *Odontesthes regia regia* with low values of 1 egg/sample and 1 larvae/ sample, respectively were determined (see Table 3-19). According to the reports of the "Oceanographic Fishing Monitoring in Selected Areas" (MOPAS, acronym in Spanish) performed by the "Instituto del Mar del Perú" in the study area, it is common to find eggs and larvae of "anchovy", "sardine" *Sardinops sagax sagax*, "silverside", "agujilla de mar común" ("subnose pipefish") *Syngnathus acicularis*, "borrachos" ("blennies") and larvae of "Pleuronectidform" flat fishes.

The presence of certain organisms of the Zooplankton and the ichthyoplankton are typical of coastal zones (such as the larvae and eggs of "silverside").

- **Plankton Community in Spring**

Primary Productivity (Phytoplankton)

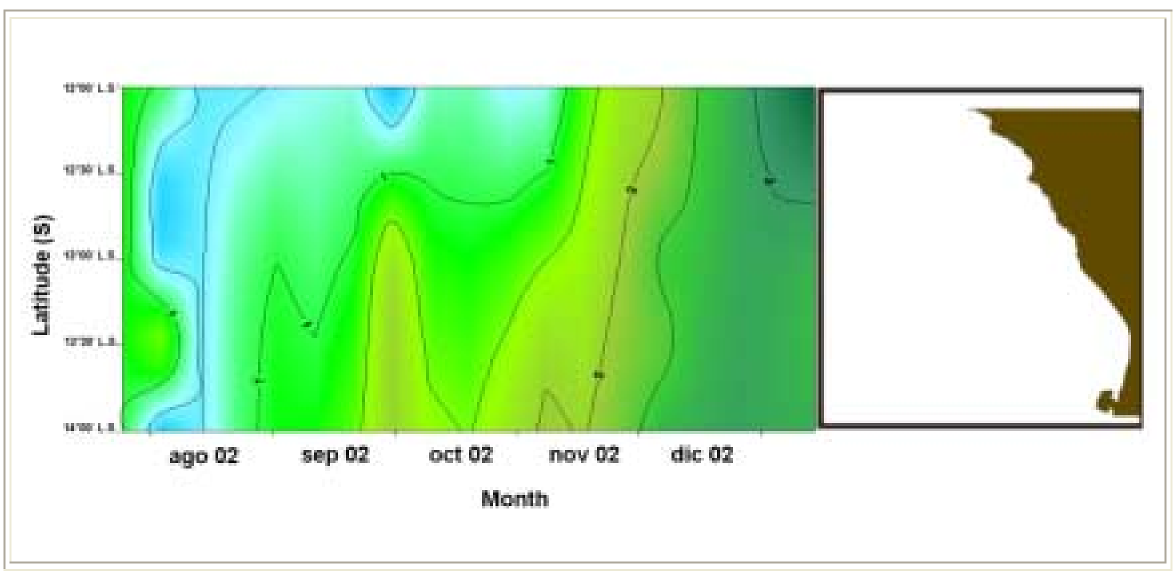


Figure 3-30. Chlorophyll "A" Monthly Distribution between 50 to 100 miles from the Shoreline. July 2002 - December 2002 (between 12° SL and 14° SL).

During the second sampling event a greater reduction of marine productivity was observed mainly due to cloud coverage over the Project area. Productivity values (colorometric analysis of the ocean using satellite images) were lower between June and October because of reduction in chlorophyll type A produced by plankton. However, in November and December chlorophyll production increased reflecting the seasonal variations associated with summer when productivity values were at a maximum (see Figure 3-30).

Within the annual cycle the spring season corresponds to the time of phytoplankton flowering, but the primary production, expressed as the number of cells, is not so high and thus it can be considered as moderate which would be related to the environmental anomalies due to the proximity of the El Niño phenomenon.

A total of 129 phytoplankton species were identified during the spring sampling event, of which 72 were diatoms, 48 dinoflagellates, 2 silicoflagellates, 2 cocolithophorids and 5 phytoflagellates (See Table 3-20).

The density was higher at the water surface and generally off-shore which presented values that range from 2,722 to 70,866 cel/50 ml. The higher cell count consisted mainly of diatoms: *Amphora, Guinardia delicatula*, *Guinardia striata, Pleurosigma* and *Leptocylindrus danicus.*

On average, the numerically predominant group was the microflagellates (46.80%) although due to their small size they represent only a small portion of biomass. The second group was the diatoms (35.7%) with the dominant species *Amphora* sp*, Skeletonema costatum, Guinardia delicatula, Guinardia striata, Leptocylindrus danicus* and *Pleurosigma* sp. Almost all of those species are larger in size and thus represent a greater portion of biomass. The third important group was dinoflagellates (16.43%) represented by *Prorocentrum gracile, Gymnodinium sanguineum* and *Exuviaella marina*. All of these species generally produce red tides. At the bottom of the water column, the microflagellates decreased and the diatoms were predominant.

The distribution of the greatest densities of phytoplankton cells presents a similar pattern to the one observed during the autumn sampling in June with an increase in density at a further distance from the coast and at the water surface level.

Within the micro-zooplankton, the cilliates of the order Tintinnidae, *Amphorides amphora* and *Eutintinnus tubulosus* were very abundant. (See Table 3-21). The species belonging to the micro-plankton were not considered within the diversity analysis of the phytoplankton and were considered as accompanying fauna.

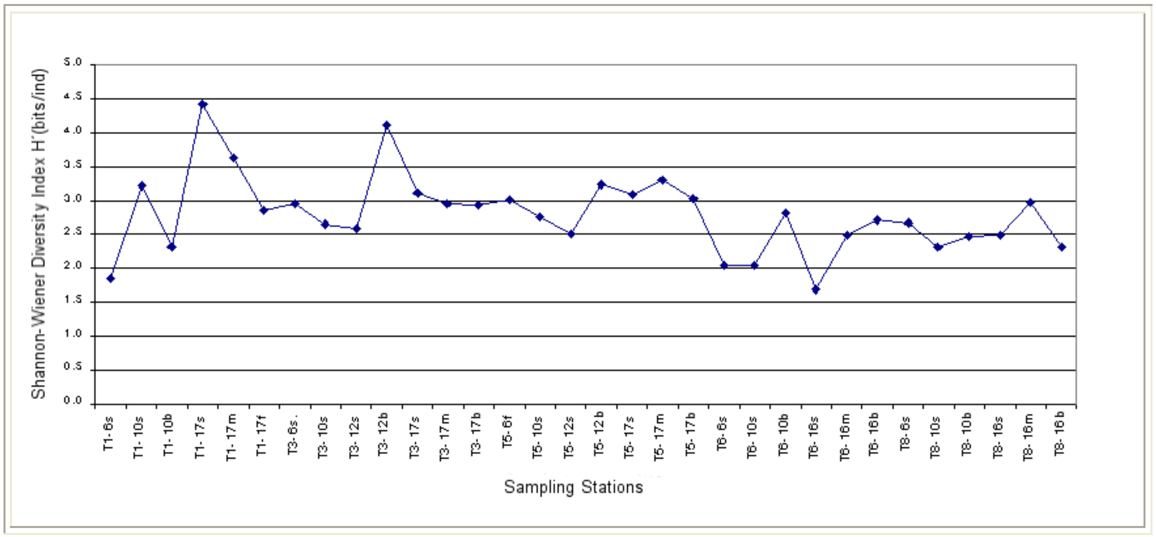


Figure 3-31. Variations of the Diversity Index (H') of the Phytoplankton by Sampling Site. Pampa Melchorita, Spring 2002.

Figure 3-31 depicts that to the the diversity values of phytoplankton. The values of diversity index ranged from 1.7 to 4.4 bits/individual.

The sampling stations that have highest diversity index values were station T1-17 at the surface (4.4 bits/individual) and station T3-12 at the sea bottom (4.4 bits/individual). This last station corresponds with the end of the trestle that is planned.

Along transects T5 and T8, similar diversity index values were observed, without many fluctuations associated by the depth of the sample.

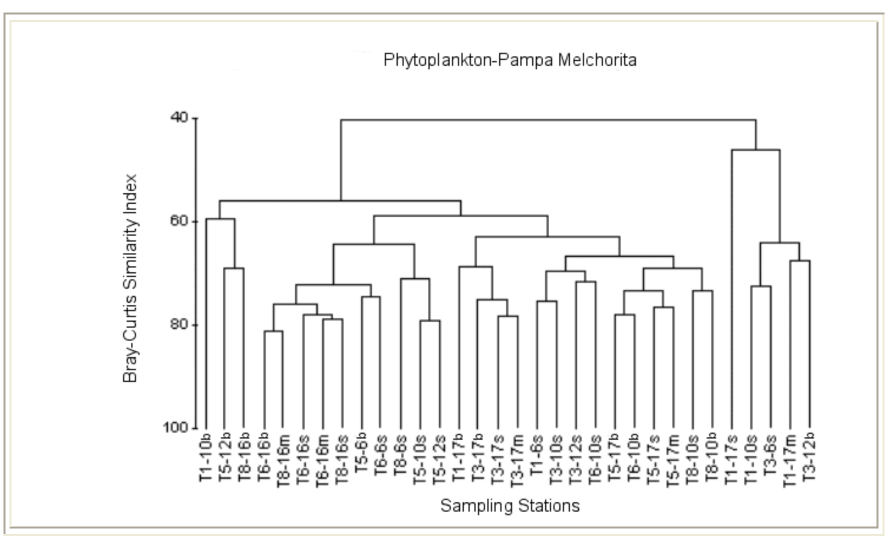


Figure 3-32. Cluster Analysis of Phytoplankton by Sampling Station. Pampa Melchorita, Spring 2002.

Figure 3-32 shows the cluster analysis of phytoplankton by sampling station where at 50% of similarity index of 3 groupings were formed. The first group was evaluated by 27 sampling sites having a similar pattern of abundance of different species. The second group corresponds to sampling station T1-17 at the water surface, where the greatest diversity index value was recorded. The third group consisted of the four sampling stations where there was a distinct predominance of some of the five taxonomic groups observed. This grouping allowed to distinguish differences between T1 and T3 (at 6 and 12 m of depth) based on the pattern of species composition with respect to other transects.

No similar distributions were observed during the spring sampling event when compared to the June (autumn sampling), event that indicated marked differences with respect to the plankton species along the coast or along the transects. This rare ability is due to the fact that the composition and distribution of the phytoplankton is very variable and depends on the oceanographic conditions and the seasonal changes.

Secondary Production (Zooplankton)

The main groups of Zooplankton were represented by five groups, of which the copepods have the highest concentrations and volumes of the Zooplankton. Within the group the following were observed: copepods, euphasids, cladocerans and decapods, being the species *Acartia tonsa*, *Centropages brachiatus*, *Corycaeus dubius*, *Oithona* sp, *Paracalanus parvus* and *Scolecitrix* sp as the main species observed. Among them the specie *Acartia tonsa* was the most abundant with values that ranged between 5,920 and 8,421,376 individuals/sample (see Table3-22). Also, it was determined the copepod *Centropages brachiatus* which is an indicator specie of cold coastal waters with concentrations ranging from 160 to 49,664 individuals/sampling.

Based on the data recorded, there is evidence of the marked presence of cold coastal waters in the area.

During this sampling event the main species of ichtyoplankton registered high values, where eggs of “anchovy” and “engraulidae” were abundant and ranged from 1,536 to 88,832 and 32 to 2,048 eggs/sample, respectively (see Table 3-23).

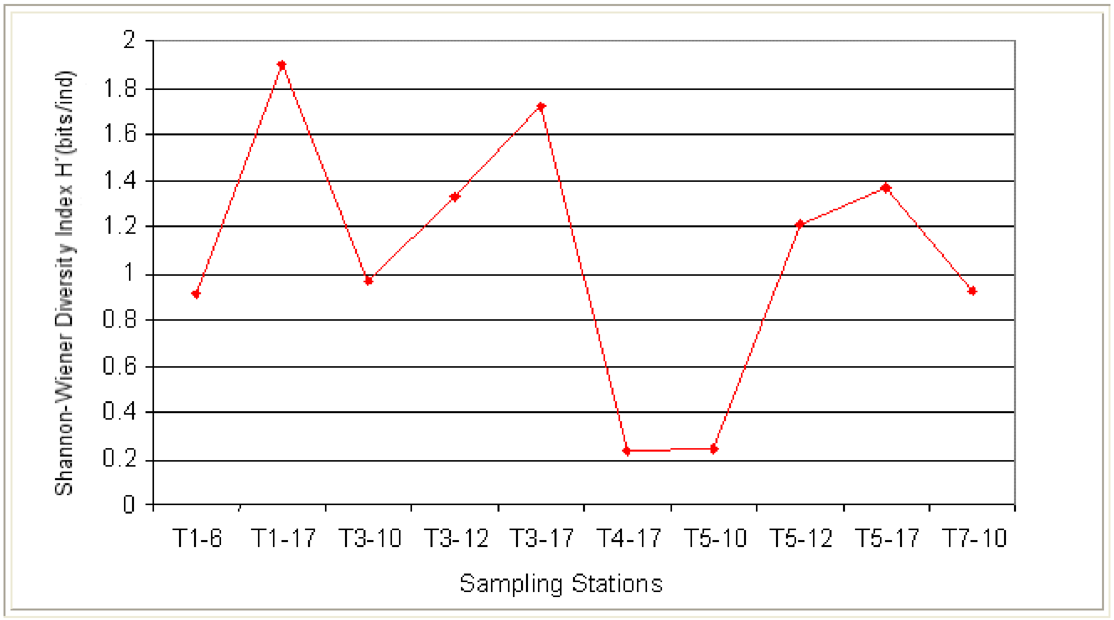


Figure 3-33. Variations of the Diversity Index (H') of Zooplankton by Sampling Station. Pampa Melchorita, Spring 2002.

Figure 3-33 shows the variation of the diversity levels of Zooplankton. The diversity values ranged from 0.23 to 1.33 bits/individual. The highest value of diversity corresponds to transect T1 (at 17 m of depth); and at transect T4 (at 17 m of depth) and transect T5 (at 10 m of depth) corresponds the lowest values of diversity were observed.

With regard to the entire study area, it was observed a decrease of the diversity index, in contrast with the sampling event in June (autumn sampling), where 11 taxonomic groups were reported. *Acartia tonsa* would be in the peak of its population development within the maturing status of the Zooplankton.

As in the case of phytoplankton, the greatest diversity index of Zooplankton is located between transects T1 and T3.

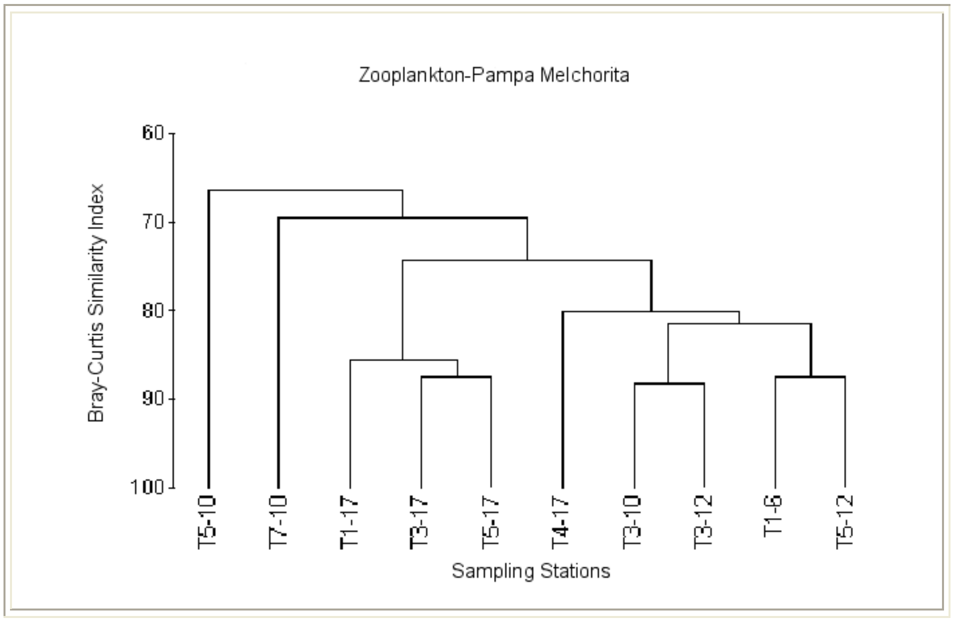


Figure 3-34. Cluster analysis of Zooplankton by Sampling Stations. Pampa Melchorita, Spring 2002.

The cluster analysis represented in Figure 3-34 depicts three groupings at 70% of similarity. The first group corresponds to the sampling point where the lowest diversity index was registered (T5-10). The second group corresponds to the sampling point where the highest abundance, but not the highest diversity, was registered (T7-10). The third group at those sampling points represents where the same species with similar abundance were observed. This grouping pattern was dependant on the presence of *Acartia tonsa* that increases in abundance as the distance from the coast is increased.

Regarding ichtyoplankton, the presence of eggs of “anchovy” *Engraulis ringens*, larvae of “silverside” *Odontesthes regia regia* and eggs and larvae of other groups was recorded. In the case of the anchovy, the number of eggs ranged from 256 to 88,832 by sample were reported, with T1 and T7 as transects having the largest abundance. When comparing this data with data obtained from June (autumn sampling), it appears that the study area is the spawning zone of *Engraulis ringens* with intensified spawning occurring during the months of September and the beginning of October. A similar pattern occurred with the larvae of *Odontesthes regia regia*, however, this was not as notorious as *E. ringens* due probably to “over-exploitation”.

Reports from the “Oceanographic Fishing Monitoring at Selected Areas” (MOPAS, acronym in Spanish) written by the “Instituto del Mar del Perú” indicates how common it is to find eggs and larvae of “anchovy”, “sardine” *Sardinops sagax sagax*, “silverside”, *Syngnathus acicularis* “subnose pipefish”, “blennies” (borrachos) and larvae of “Pleuronectiform” flat fishes at the same study area.

The presence of indicators from the Zooplankton and ichtyoplankton are typical of the coastal zones (such as the larvae and eggs of "silverside").

- **Benthic Community in Autumn**

The following sub-aquatic observations were made during the autumn sampling period. The visibility in the area of the Project development was poor with visibility extending to 10 cm (diver at the sea bottom) caused by the removal of the benthos and the strong hydrodynamics in the water column. The sampling zone had strong currents at depths ranging from 6 to 12 m and moderate to strong currents at 16 m of depth.

The macro-benthos structure was found as follows. A total of 54 taxonomical units were identified comprising Mollusca, Crustacea, Turbellaria, Nemertea, Sipunculida, Actiniaria, Echinodermata and Polichaeta. The most abundant group was the Molusca, followed by Crustacea and Polichaeta (See Table 3-24).

Within the Molusca, the following three bivalve species were found in abundance: 1) *Donax marincovinchi, 2) Mulina edulis,* and 3) *Semimytilus algosus*. *Donax marincovinchi* was found at transects T1, T3, T4, T5, T7 at a depth of 6 m having an average of 1,500 individuals/m^2 in T3, T4 and T5. *Mulina edulis* was recorded at all transects, at depths of 6 and 10 m, registering at these depths the highest densities of 100 individuals/m^2. At 17 m of depth a density of 55 individuals/m^2 was found. *Semimytilus algosus* was found at 6 m of depth in all transects, but generally they were larvae trying to settle in a hard substrate. It was observed that at stations on transects T3 and T4 the substrate changes from fine sand to sand and pebbles.

Within the group of the Crustacea, the predominant cirripedes was *Balanus laevis* recorded at transects T1 and T7.

The benthic diversity in this area was low, having as a minimum value 0.10 to 2.48 bits/individuals, as is characteristic of a subtidal ecosystem in sandy substrate. In general, at transects T3 and T4 the lowest diversity values were found and attributed to the differences in the substrate sampled. It was evident that at a greater depth there was a greater diversity (see Figure 3-35).

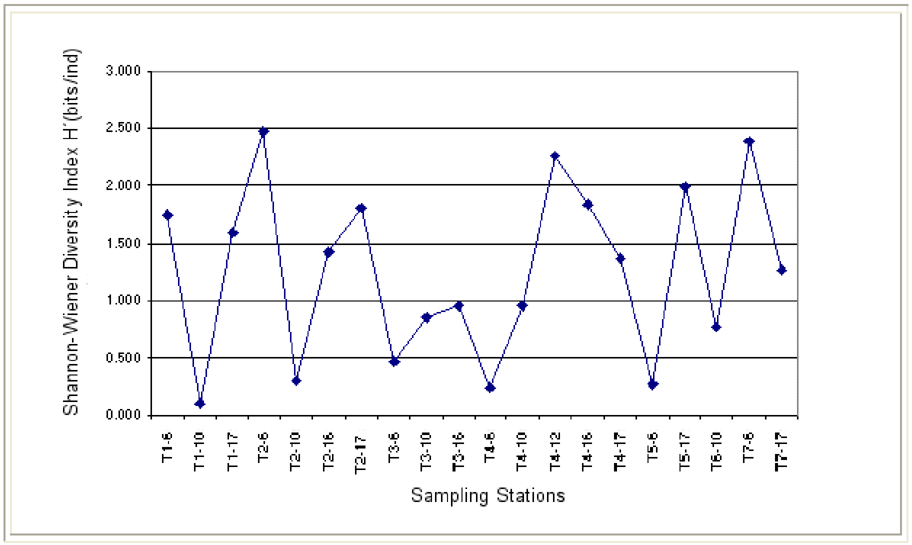


Figure 3-35. Variations of the Diversity Index (H´) of Subtidal Macro-Benthos by Sampling Site. Pampa Melchorita, Autumn 2002

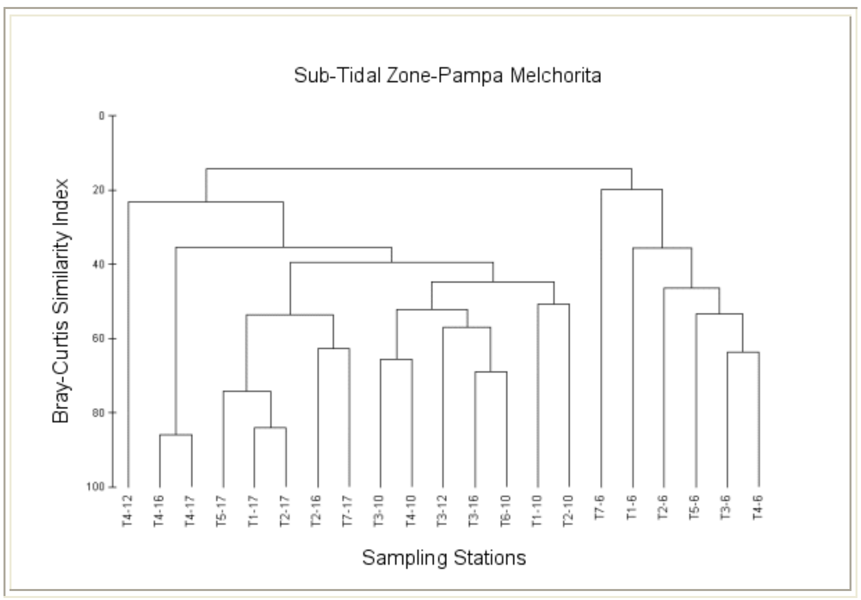


Figure 3-36. Cluster Aalysis by Sampling Station of the Macro-Benthos of Sandy Beach. Playa Melchorita, Autumn 2002

The dendogram at Figure 3-36 performed using a similarity matrix transformed to Log X + 1, based in the relationship between the sampled stations and the number of species and individuals found, shows three important groupings delimited by the depth. At 50% of similarity there were nine groups, characterized by two variables: the type of substrate related to the distance from the coast, and the depth. At transect T3 depths of 10 and 16 m a homogeneity in the composition of species was observed. In general, at 6 m of depth the composition of species in the different transects was homogenous.

- **Benthic Community in Spring**

The following sub-acuatic observations were made during the spring sampling period. The diving activity was conducted in the morning and afternoon, with poor visibility extending only to 10 cm of distance (diver at the sea bottom). The hydrodynamic conditions were similar to the spring sampling event with strong currents at depths ranging from 6 to 12 m and moderate-to-strong at 16 m of depth.

The macro-benthos structure was found as follows. A total of 36 taxonomic units were identified, among Actiniaria, Equinodermata, Plathelminthes, Polichaeta, Mollusca, Arthropodes and Phoronides. The most abundant group was Mollusca followed by Polichaeta and Crustacea (See Table 3-25).

The predominant mollusk at the study area was *Mulina edulis* with a lower abundance at lesser depths and ranging from 0 to 790 individuals/m^2 and *Semmimytilus algosus* with a greater abundance at T1- 6m.

In the case of polychaetes, the species having the greatest abundance were *Owenia sp*. and *Nepthys ferruginea*.

In the group of Crustacea, the most prominent specie was the gammarides with increasing abundance from south to north (T1 to T8).

In contrast to the June sampling, it was observed a drastic decrease of the *Donax marincovichi* population (probably it has been displaced by *Mulina edulis*) as well as other species recorded in the autumn sampling.

The diversity in this zone ranged from 0.073 to 3.07 bits/individuals. Station T6-6 at medium depth presented the highest diversity value (see Figure 3-37). Transect T3 had the lowest diversity values coinciding with the values observed in June which is due to the type of substrate in the area. However, the pattern of “at greater depth, greater diversity” was not observed.

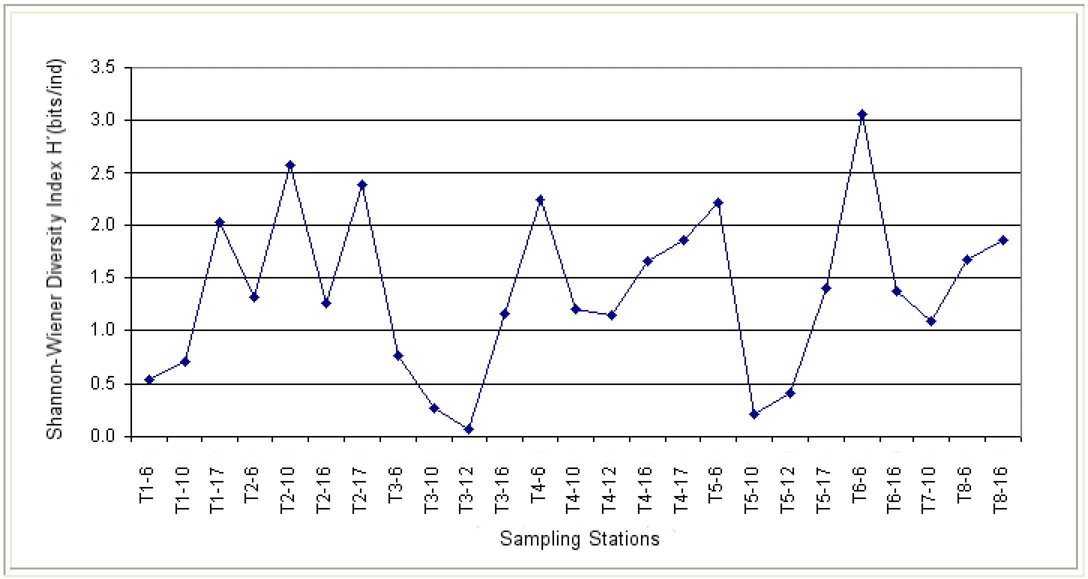


Figure 3-37. Variations of the Diversity Index (H') of the Subtidal Macro-Benthos by Sampling Site. Pampa Melchorita, Spring 2002.

The dendogram at Figure 3-38 performed using a similarity matrix transformed to Log X + 1 based on the relationship between the stations studied and the number of species and individuals found, shows at 50% of similarity six groupings of which three were the most important ones delimited by the depth and the number of species found.

The first grouping formed by transect T1-6m, was characterized by being the only sampling station in which the presence of *Semimytilus algosus* was found and which was the dominant specie. The second grouping was represented by station T4-6m having the least quantity of individuals by sample.

The third grouping comprises T5 and T6 at 6m of depth. In these stations the species had a more even distribution, probably related to the depth of the samples.

The fourth grouping comprises stations at 16 and 17 m of depth, which present a very similar distribution of the species. T4-12m is the exception included in this grouping.

Stations T2-6m, T2-10m and T7-10m present the same species number observed in the set of the fifth grouping.

The sixth grouping was formed by the stations located at 10 and 12 m of depth including the station with the least diversity value in all the study area (T3-10m).

When comparing this sampling period with the sampling performed in June of 2002, there is no evidence of variation of distribution in the taxa in relation to depth during this period.

At 50% of similarity nine groupings were observed characterized by two variables, the type of substrate (given by the distance from the coast) and the depth. In transect T3, depths 10 to 16 m were showing a homogeneous composition of species. In general, at 6 m of depth the composition of species in the different transects was homogenous.

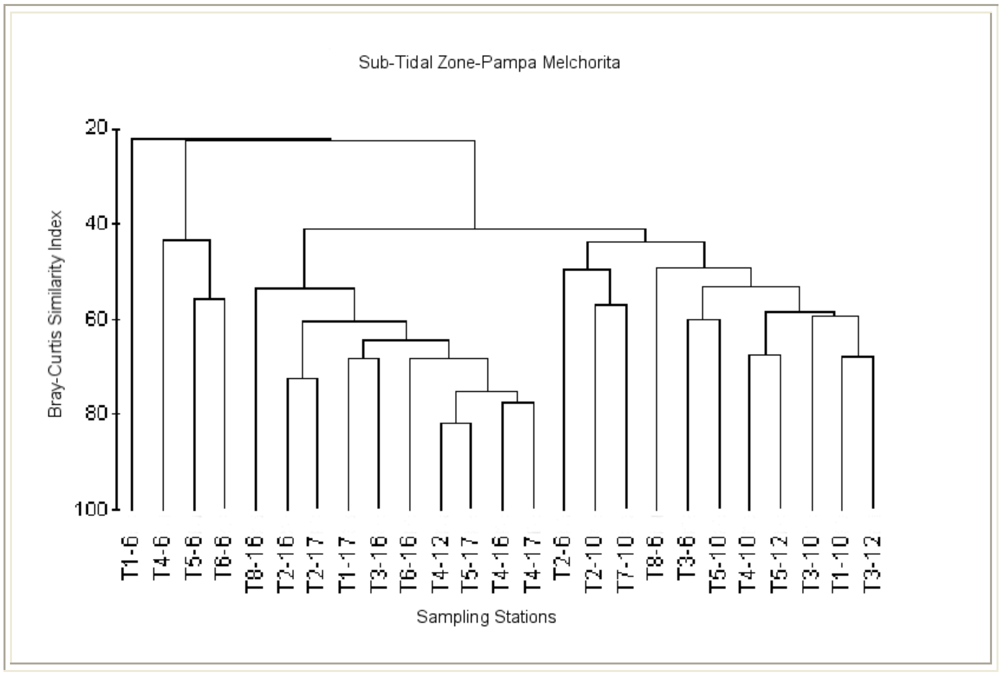


Figure 3-38. Cluster Analysis by Sampling Station of the Macro-Benthos of Sandy Beach. Playa Melchorita, Spring 2002.

- **Fish**

Autumn Sampling

The species recorded during the autumn sampling were: “common flatfish” *Paralichthys adspersus* with three species captured in a lapse of two hours. The average total length of the fish caught was of 32 cm with an average of 620grams in weight. Another specie captured was the “silverside” *Odonthesthes regia regia* with 11 fish caught in a period of two hours. The average total length was 14 cm and the weight was 65 grams.

Other typical species recorded and reported in this zone during various earlier sampling studies performed by the "Instituto del Mar del Perú" were the presence of: "longnose anchovy" *Anchoa nasus*, "cachema" (common Peruvian weakfish) *Cynoscion analis*, "pintadilla" (Peruvian morgwon) *Cheilodactylus variegatus*, "anchoveta negra" *Engraulis ringens*, "mojarrilla" (spined drum) *Stellifer minor,* and "mismis común" (mismis kingcroaker) *Menticirrhus ophicephalus* (ARONES, et al. 2000).

The study area is located to the south of the Lima Department. Cerro Azul and Tambo de Mora are the two closest disembarkation sites to the area. In the Ica Department there is eight disembarkation sites that include from north to south: 1) Tambo de Mora, 2) Pisco, 3) San Andrés, 4) La Puntilla, 5) El Chaco, 6) El Chaco-Lagunillas, 7) Lagunillas and 8) Laguna Grande. The main disembarkation sites are Pisco and Tambo de Mora these being suitable for industrial fishing.

Tambo de Mora represents an important port for receiving more than 75% of total anchovy production for processing in Peru. Other important species for artisanal fishing are "lisa" (*Mugil cephalus*), "raya" (*Urotrygon ssp*), "tollo" (*Mustelus whitneyi*), "cabinza" (*Isacia conceptionis*) and "pejerrey "(*Odontesthes regia regia*). In Pisco, other species besides anchovy are "cabinza" (*Isacia conceptionis*), "jurel" (*Trachurus picturatus murphyi*), "raya" (*Urotrygon ssp*), "cojinova" (*Seriolella violacea*), "pejerrey" (*Odontesthes regia regia*), and mussels like "abalón" (*Sinum cymba*), "almeja" (*Gary solida*), "choro" (*Aulacomya ater*), "pota" (*Dosidicus gigas*), "pulpo" (*Octopus spp*.). This could vary according to the ocean conditions.

In the littoral zone of the coastline of Peru exist natural banks of different hydro-biological species that makes it one of the best fishing zones in the world. An explanation for this behavior is the recurrent upwelling zone of sub-superficial cold water extended from Pisco to the north, including the study area. This contribution of cold water supports the phytoplankton development and fisheries, industrial as well as artisanal.

A comparison of the disembark volumes could be stated with registered data from Tambo de Mora. It should be noted that Tambo de Mora registered an increased fish process production during the years 1997 and 1998, where El Niño effect was present as compared with year 1996 when an opposite event such as La Niña was registered with production decreased.

Fish Production of Tambo de Mora (1995 – 2000)

Years	1995	1996	1997	1998	1999	2000
TOTAL (M.T.)	8970902	9486883	7837650	4310271	8392378	10626323
Tambo de Mora	289898	168087	407665	219043	276016	510015
% comparative	3.23%	1.77%	5.20%	5.08%	3.29%	4.80%

- **Spring Sampling**

During the sampling in October, no small-scale fishing activity was observed due to the closure of the Cerro Azul cove for fishing. For this reason, records of fish captures were not available. However, at the shore zone, fishing with “boulters” was performed, registering captures of “common flatfish” *Paralichthys adspersus*, and “silverside” *Odontesthes regia regia*, sometimes used as a bait.

3.2.2.3 Birds and Mammals

Autumn Survey

Among the birds typical of this zone the following species were observed:

Sula variegata “piquero común”

Pelecanus thagus “Peruvian pelikan”

Coragyps atratus “black-head turkey buzzard”

Cathartes aura “red-head turkey buzzard”

Haematopus ostralegus “oystercatcher”

Sterna sp “gaviotín”

Larus modestus “gray seagull”

Larus belcheri “Peruvian seagull”

Larus dominicanus “Dominican seagull”

Regarding the above referencd species, *Larus modestus* are present along the Peruvian coast reaching as far as Valparaiso (Chile). This specie nests in an area located in Antofagasta.

The greatest concentration of birds was observed during the second observation transect, but the difference with the first observation transect was not significantly higher and included finding almost the same quantity of species in both observation transects.

The species found at the shore were turkey buzzards and oystercatcher. The turkey buzzards were observed feeding, flying or resting in the hills, and the oystercatcher were observed in the vegetation near the shore. (See Table 3-26).

Other bird species were obsereved over water seeking food and/or feeding, while others such as "gray seagulls" and "gaviotines" *Sterna sp* were seen resting in the shore.

None of the bird species were found reproducing or trying to reproduce within the limits of the study area.

The low diversity of marine bird species is due to the majority of, the species being,migratory species and there was no migration during this season (autumn) in Peru.

Regarding marine mammals, the following species were observed during the autumn survey:

Otaria byronia	sea lions or maned seals; also called "common wolf"
Tursiops truncatus	"bottle-nose dolphin"

Both species were observed feeding in areas near the shore, associated with a group of marine birds (*Larus modestus*).

The migration routes of mammals are not precisely known, however, it must be noted that presence of individuals and local groups were recorded at the surroundings of the study area.

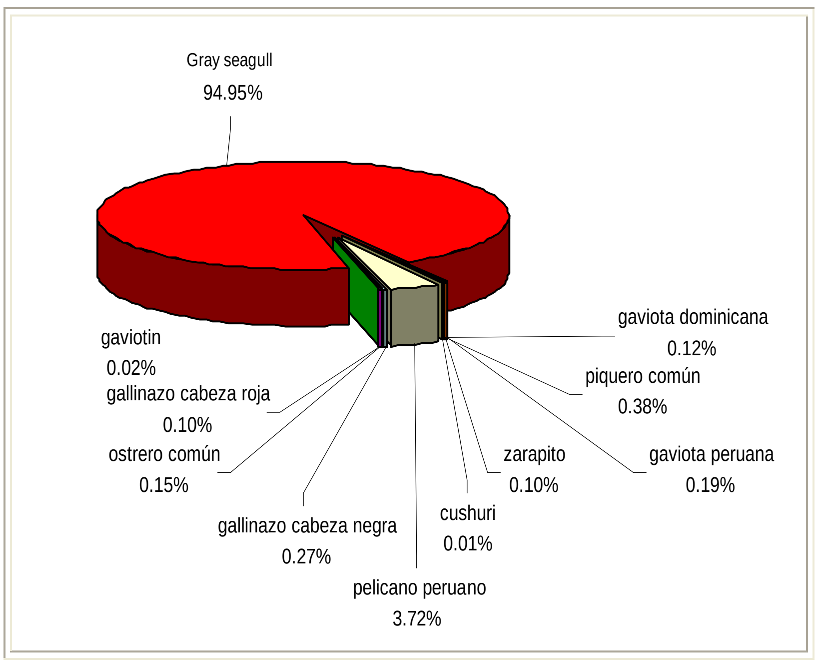
Spring Survey

During the spring survey, the largest number of total of bird species observed were the "gray seagull" *Larus modestus,* (see Table 3-27). This is a migratory bird whose reproduction areas are located in northern Chile. They travel to Peru during their non-reproductive stages. This bird specie was observed resting and eating in the coastal shore of the study area.

Two other bird species observed for the first time reported were “cushuri” *Phalacrocorax olivaceus* and “zarapito trinador” *Numenius phaoepus*. The first specie is a resident bird that usually lives along the Peruvian coast and the second bird is a migratory specie.

When comparing both surveys, the variations in numbers among the different bird species is mainly due to the fact that individuals were observed during non-reproductive activities, either feeding, searching for food or resting and in general these species were in transit over the study area.

During the spring survey, no mammals were reported. Only four sea lions and four dolphins were found dead on the shore probably associated with incidental captures.



A list of marine protected species of mammals, birds and reptiles is provided in Table 3-15 in Chapter Four (see at section 4.2.1).

3.2.3 Summary of Results

The analysis performed characterized the marine zone of Pampa Melchorita as a sandy beach ecosystem typical of the central coast of Peru.

Even though the diversity levels are not as high as in a rocky beach system, Pampa Melchorita represents an environment that did not suffer any alteration from human activities (such as those generated by spills, dumps of industrial wastes, wastewater collectors and waters from agriculture). This is evident by the high diversity of organisms recorded at the subtidal zone.

The physical and biological parameters analyzed during the spring season in Pampa Melchorita are similar to those reported in nearby zones and coincide with characteristics typical of the coastal zone waters. The variation of some of the oceanographic parameters with respect to previous determinations might be due to the anomalous conditions that were occurring in view of the proximity of the "El Niño" event.

The analysis of the plankton community during autumn reveals that T3 presents the highest diversity. The analyses of the inter-tidal and subtidal benthonic community show that T3 is one of the zones with lower diversity. This is due to the type of substrate present and which do not provide a suitable habitat for a series of organisms. However, it is necessary to take into account that the plankton is dependent on the temperature and the displacement of the water mass and hence it is necessary to perform comparative studies to determine if this zone has the largest primary productivity of Pampa Melchorita.

The analysis of the plankton community during spring reveals that the largest diversity in the area covered from transects T1 to T3 where the largest diversity of phytoplankton and Zooplankton was noted. It is observed that one of the greatest foci of spawning of anchovy is apparently concentrated in this zone. As observed in the Zooplankton, *Acartia tonsa* would be an indicator of "cold coastal waters".

In the analysis of the inter-tidal benthonic community during the spring sampling it is observed that there is an increment of diversity from transect T4. In the case of the Subtidal zone, the greatest concentration of organisms is observed in transect T3. This transect has a good concentration of oxygen, but the hydrodynamics is very high and thus would not allow the settlement of organisms.

According to the results obtained in both sampling events, the zone qualifies with the necessary characteristics to be a water of type VI use (total coliforms, fecal coliforms, parasites and pesticide are below the permissible levels) according to the General Water Law No.17752.

The diversity values found in the study area with respect to the plankton communities and macro-benthos are influenced by the oceanographic and seasonal changes so it is necessary to monitor them in order to establish the presence of some pattern.

Melchorita Beach presents low diversity values, this is typical of sandy beaches, existing with one or two predominant species.

TABLES

Table 3-1. Families and species of cultivated plants found in the area of Pampa Clarita and its surroundings

Family	Specie	Family	Specie
Anacardiaceae	*Schinus molle*	Malvaceae	*Malvabiscus arboreus*
Anacardiaceae	*Spondias monbin*	Moraceae	*Ficus carica*
Apocynaceae	*Catharanthus roseus*	Moraceae	*Morus nigra*
Apocynaceae	*Nerium olenander*	Musaceae	*Musa sp.*
Arecaceae	*Phoenix canariensis*	Myrtaceae	*Eucalyptus sp.*
Arecaceae	*Washingtonia filifiera*	Myrtaceae	*Psidium guajava*
Boraginaceae	*Cordia lutea*	Nyctaginaceae	*Bougainvillea sp,*
Cactaceae	*Opuntia ficus-indica*	Passifloraceae	*Pasiflora edulis*
Cannaceae	*Canna indica*	Poaceae	*Arundo donax*
Caricaceae	*Carica papaya*	Poaceae	*Guadua sp.*
Casuarinaceae	*Casuarina equisetifolia*	Poaceae	*Saccharum officinarum*
Convolvulaceae	*Ipomoea batatas*	Poaceae	*Stenotaphrum secundatum*
Crassulaceae	*Kalanchoe pinnata*	Poaceae	*Zea mays*
Cucurbitaceae	*Citrulus lanatus*	Portulaccaceae	*Portulacca grandiflora*
Euphorbiaceae	*Manihot esculenta*	Punicaceae	*Punica gratanum*
Euphorbiaceae	*Ricinus commnunis*	Rosaceae	*Fragaria sp.*
Fabaceae	*Arachis hypogaea*	Rosaceae	*Rosa sp.*
Fabaceae	*Caesalpinia sepiaria*	Rutaceae	*Ruta chelepensis*
Fabaceae	*Inga feuillei*	Salicaceae	*Populus nigra*
Fabaceae	*Phaseolus lunatus*	Solanaceae	*Brugmansia suaveolens*
Fabaceae	*Phaseolus vulgaris*	Solanaceae	*Lycopersicon esculentum*
Lauraceae	*Persea americana*	Solanaceae	*Solanum muricatum*
Liliaceae	*Allium sp.*	Tamaricaceae	*Tamarix sp,.*
Liliaceae	*Aloe vera*	Vitaceae	*Vitis vinifera*
Malvaceae	*Hibisucus rosa-sinensis*		

Table 3-2. Families and species of wild plants found in the area of Pampa Clarita and its surroundigs

Family	Specie	Family	Especie
Amaranthaceae	*Alteranthera halimifolia*	Boraginaceae	*Heliotropium curassavicum*
Nyctaginaceae	*Boerhaavia sp.*	Chenopodicaceae	*Chenopodium album*
Apiaceae	*Hydrocotyle bonariensis*	Chenopodicaceae	*Chenopodium ambrosioides*
Araceae	*Xanthosoma sp.*	Chenopodicaceae	*Chenopodium murale*
Asteraceae	*Mikania sp.*	Cucurbitaceae	*Luffa operculata*
Asteraceae	*Picrosia longifolia*	Cyperaceae	*Cyperus esculentus*
Brassicaceae	*Roripa nasturtium-aquaticum*	Cyperaceae	*Cyperus hermafroditus ?*
Commelinaceae	*Commelina fasciculata*	Euphorbiaceae	*Acalypha infesta*
Cyperaceae	*Scirpus americanus*	Euphorbiaceae	*Chamaesyce hirta*
Cyperaceae	*Scirpus maritimus ??*	Euphorbiaceae	*Chamaesyce hypericifolia*
Fabaceae	*Vigna luteola*	Fabaceae	*Crotalaria incana*
Lamiaceae	*Mentha piperita*	Fabaceae	*Desmanthus virgatus*
Onagraceae	*Ludwigia peruviana*	Malvaceae	*Sida rhombifolia*
Poaceae	*Panicum purpurascens*	Malvaceae	*Sidastrum paniculatum*
Poaceae	*Paspalidium geminatum*	Papaveraceae	*Argemone subfusiformis*
Poaceae	*Paspalum racemosum*	Plantaginaceae	*Plantago major*
Poaceae	*Paspalum vaginatum*	Poaceae	*Brachiaria mutica*
Poaceae	*Pennisetum purpureum*	Poaceae	*Cenchrus echinatus*
Poaceae	*Phragmites australis*	Poaceae	*Chloris halophila*
Poaceae	*Polypogon elongatus*	Poaceae	*Cynodon dactylon*
Poaceae	*Polypogon viridis*	Poaceae	*Digitaria ciliaris*
Polygonaceae	*Polygonum hidropiperoides*	Poaceae	*Echinochloa colonum*
Salicaceae	*Salix sp.*	Poaceae	*Eleusine indica*
Typhaceae	*Typha domingensis*	Poaceae	*Lepthochloa uninervia*
Zannicheliaceae	*Zannichellia palustris*	Poaceae	*Setaria parviflora*
Aizoaceae	*Trianthema portulacastrum*	Poaceae	*Sorghum halepense*
Amaranthaceae	*Amarantus celosioides*	Polygonaceae	*Rumex crispus*
Amaranthaceae	*Amarantus spinosus*	Portulacaceae	*Portulaca oleracea*
Amaryllidaceae	*Stenomesson sp.*	Portulaccaceae	*Portulacca oleraceae*
Asteraceae	*Acanthospermum hispidum*	Rubiaceae	*Borreria laevis*
Asteraceae	*Acmella oppositifolia*	Solanaceae	*Datura stramonium*
Asteraceae	*Ageratum conyzoides*	Solanaceae	*Nicandra physaloides*
Asteraceae	*Ambrosia peruviana*	Solanaceae	*Physalis angulata*
Asteraceae	*Bidens pilosa*	Solanaceae	*Solanum americanum*
Asteraceae	*Eclipta prostrata*	Urticaceae	*Parietaria debilis*
Asteraceae	*Encelia canescens*	Verbenaceae	*Phyla nodiflora*
Asteraceae	*Flaveria bidentis*	Verbenaceae	*Verbena litoralis*
Asteraceae	*Galinsoga parviflora*	Lecideaceae	*Lecidea sp.*
Asteraceae	*Galinsoga sp.*	Parmeliaceae	*Cetraria sp.*
Asteraceae	*Heterosperma diversifolia*	Parmeliaceae	*Parmelia sp.*
Asteraceae	*Sonchus oleraceus*	Ramalinaceae	*Ramalina sp.*
Asteraceae	*Spilanthes leiocarpa*	Teloschistaceae	*Xanthoria sp.*

Table 3-3. Family, Specie and Habitat of the Plants found at Pampa Melchorita

MONOCOTILEDON	
Family	**Specie**
Bromeliaceae	*Tillandsia latifolia G. Meyen*

LICHENS:		
Family	**Specie**	**Niche**
Arthoniaceae	*Arthonia* sp*?*	Saxícola
Micareaceae	*Micarea* sp	Saxícola
Physiaceae	*Buellia* sp	Over *Tillandsia*
Teloschistaceae	*Bryoria* sp	Saxícola
Ramalinaceae	*Siphula* sp*?*	Saxícola
Teloschistaceae	*Caloplaca* sp	Saxícola
Chrysothriceae	*Chrysothri sp*	Over *Tillandsia*

Table 3-4. Location of transects and stations sampled during the Autumn of 2002

Station No.	East	North
T1-0	359660.55397	8533578.57758
T1-6	359337.63245	8533256.38946
T1-10	358983.88796	8532903.44837
T1-17	356752.44422	8530677.07253
T2-0	359032.01141	8534367.57255
T2-6	358742.38370	8534078.59904
T2-10	358419.05274	8533755.99842
T2-12	358259.33919	8533596.64562
T2-16	357008.03290	8532348.16574
T2-17	355397.00340	8530740.77519
T3-0	358698.29765	8534739.28542
T3-6	358389.33915	8534431.04014
T3-10	358163.30463	8534205.52743
T3-12	357934.60013	8533977.35089
T3-16	356376.55964	8532422.90712
T3-17	355133.83297	8531183.04928
T4-0	358369.37806	8535109.27317
T4-6	358083.83893	8534824.38028
T4-10	357736.77350	8534478.10033
T4-12	357553.42520	8534295.16698
T4-16	356596.45881	8533340.36642
T4-17	355123.19078	8531870.43271
T5-0	357362.31008	8536218.70536
T5-6	357044.91138	8535902.01752
T5-10	356667.82595	8535525.77661
T5-17	354547.24616	8533409.94611
T6-0	357047.72876	8536609.56406
T6-10	356336.58667	8535899.83964
T7-0	356716.60963	8536984.08088
T7-6	356375.87950	8536644.11462
T7-10	356017.06575	8536286.10528
T7-17	354179.87653	8534453.03475

Table 3-5. Location of Transects and Stations sampled during Spring of 2002

Station	East	North
T1-0	359660.55397	8533578.57758
T1-6	359337.63245	8533256.38946
T1-10	358983.88796	8532903.44837
T1-17	356752.44422	8530677.07253
T2-0	359032.01141	8534367.57255
T2-6	358742.38370	8534078.59904
T2-10	358419.05274	8533755.99842
T2-12	358259.33919	8533596.64562
T2-16	357008.03290	8532348.16574
T2-17	355397.00340	8530740.77519
T3-0	358698.29765	8534739.28542
T3-6	358389.33915	8534431.04014
T3-10	358163.30463	8534205.52743
T3-12	357934.60013	8533977.35089
T3-16	356376.55964	8532422.90712
T3-17	355133.83297	8531183.04928
T4-0	358369.37806	8535109.27317
T4-6	358083.83893	8534824.38028
T4-10	357736.77350	8534478.10033
T4-12	357553.42520	8534295.16698
T4-16	356596.45881	8533340.36642
T4-17	355123.19078	8531870.43271
T5-0	358166.09966	8535336.95286
T5-6	357866.11432	8535037.64645
T5-10	357529.92697	8534702.21996
T5-12	357329.25559	8534502.00274
T5-16	356371.26508	8533546.18038
T5-17	355076.87427	8532254.71905
T6-0	357814.40401	8535691.74305
T6-6	357534.10581	8535412.07261
T6-10	357164.82439	8535043.61824
T6-16	355865.16217	8533746.86676
T7-0	357047.72876	8536609.56406
T7-6	356703.33018	8536265.85204
T7-10	356336.58667	8535899.83964
T7-16	355124.24845	8534689.91826
T8-0	356716.60963	8536984.08088
T8-6	356375.87950	8536644.11462
T8-10	356017.06575	8536286.10528
T8-16	354928.56870	8535200.04847

Table 3-6. Values of physical and chemical parameters of aquatic quality in surface, medium and bottom water samples. Autumn 2002. Playa Melchorita

S= Surface M= Medium B= Bottom

Stations	levels	Oxygen (ml/l-1)	pH	Suspended Solids mg/L	Total Nitrogen mg/L	Organic Nitrogen mg/L	Total Phosphor mg/L	Sulfates mg/L	Chlorophyll mg/L
T1-0	S		7.3	9	< 0.10	< 0.1	< 0.05		0.031
T1-6	S	5.79							
	M								
	B	0.5							
T1-10	S	5.73							
	M								
	B	1.41							
T1-17	S	6.28	7.2	5	0.61	0.6	0.1		< 0.001
	M	1.55							
	B	1.26							
T2-0	S		7.0						
T2-6	S	6.14							
	M								
	B	1.1							
T2-10	S	6.15							
	M								
	B	1.45							
T2-12	S	6.25							
	M								
	B	1.39							
T2-16	S	6.28							
	M								
	B	0.65							
T2-17	S	6.25						1710	
	M								
	B	0.6							
T3-0	S		7.0						
T3-6	S	5.62							
	M								

S= Surface M= Medium B= Bottom

Stations	levels	Oxygen (ml/l-1)	pH	Suspended Solids mg/L	Total Nitrogen mg/L	Organic Nitrogen mg/L	Total Phosphor mg/L	Sulfates mg/L	Chlorophyll mg/L
	B	1.15							
T3-10	S	5.92							
	M								
	B	0.95							
T3-12	S	5.97							
	M								
	B	0.87							
T3-16	S	6.1							
	M								
	B	0.7							
T3-17	S	6.15							
	M	1.55							
	B	0.55							
T4-0	S		7.4						
T4-6	S	5.93							
	M								
	B	3.00							
T4-10	S	5.73							
	M								
	B	1.21							
T4-12	S	5.89							
	M								
	B	1.06							
T4-16	S	5.83							
	M								
	B	0.75							
T4-17	S	5.82						2005	
	M								
	B	0.61							
T5-0	S		7.4						
T5-6	S	6.04							

S= Surface **M= Medium** **B= Bottom**

Stations	levels	Oxygen (ml/l-1)	pH	Suspended Solids mg/L	Total Nitrogen mg/L	Organic Nitrogen mg/L	Total Phosphor mg/L	Sulfates mg/L	Chlorophyll mg/L
	M								
	B	0.64							
T5-10	S								
	M								
	B								
T5-17	S	5.45							
	M	1.55							
	B	0.73							
T6-0	S		7.5						
T6-6	S								
	M								
	B								
T6-10	S	6.1							
	M								
	B	0.4							
T7-0	S		7.5						
T7-6	S	5.64							
	M								
	B	1.35							
T7-10	S	5.6							
	M								
	B	0.34							
T7-17	S	5.36							
	M	1.55							
	B	0.53							
MDL				5	0.10	0.1	0.05		0.001

MDL= Method Detection Limit

Table 3-7. Pesticides analyzed at water samples in Autumn 2002.

Stations	Levels	Lindano ng/l	Heptacloro ng/l	Aldrin ng/l	Dieldrin ng/l	Endrin ng/l	Endosulfan ng/l	Metoxicloro ng/l	p.p-DDE ng/l	p.p-DDD ng/l	p.p-DDT ng/l
T1-0	S	<0.2	<0.3	<0.3	<0.4	<0.7	<0.6	<0.9	<0.4	<0.5	<0.4
T1-17	S	<0.2	<0.3	<0.3	<0.4	<0.7	<0.6	<0.9	<0.4	<0.5	<0.4
MDL		0.2	0.3	0.3	0.4	0.7	0.6	0.9	0.4	0.5	0.4

MDL= Method Detection Limit S= Surface

Table 3-8. Parameter values of microbiological and pollution analyzed in surface water samples. Autumn 2002, Playa Melchorita

Stations	Levels	Total Coliforms NMP/100ml	Thermotolerant Coliforms NMP/100ml	BOD mg/L
T1-0	S	< 2	<2	1
T1-17	S	<2	<2	2
LDM		--	0.3	0.4

MDL= Method Detection Limit S= Surface

Table 3-9. Values of physical and chemical parameters in water column. Spring 2002. Playa Melchorita

S= Surface M=Medium B=Bottom

Stations	Levels	Oxygen (ml/l-1)	pH	Suspended Solids mg/L	Total Nitrogen mg/L	Organic Nitrogen mg/L	Total Phosphor mg/L	Sulfates mg/L	Hardness mg/L	Chlorophyll mg/L
T1-0	S		7.1	17	0.29	0.2	0.13		6581	0.005
T1-6	S	6.20								
	M									
	B	6.06								
T1-10	S	5.36								
	M									
	B	5.18								
T1-17	S	6.30	7.3	<5	0.34	0.3	0.06		6561	0.005
	M	5.09								
	B	2.91								
T2-0	S		7.0							
T2-6	S	6.06								
	M									
	B	6.11								
T2-10	S	5.50								
	M									
	B	5.13								
T2-12	S	5.55								
	M									
	B	4.63								
T2-16	S	6.12								
	M									
	B	3.29								
T2-17	S	5.93						1966.9		
	M									
	B	2.63								
T3-0	S		7.4							
T3-6	S	6.06								
	M									
	B	6.11								
T3-10	S	5.20								
	M									
	B	5.64								
T3-12	S	5.55								
	M									
	B	4.09								

S= Surface M=Medium B=Bottom

Stations	Levels	Oxygen (ml/l-1)	pH	Suspended Solids mg/L	Total Nitrogen mg/L	Organic Nitrogen mg/L	Total Phosphor mg/L	Sulfates mg/L	Hardnes s mg/L	Chlorophyll mg/L
T3-16	S	6.70								
	M									
	B	6.00								
T3-17	S	6.26								
	M	4.72								
	B	3.47								
T4-0	S		7.7							
T4-6	S	4.94								
	M									
	B	4.70								
T4-10	S	5.37								
	M									
	B	3.01								
T4-12	S	5.17								
	M									
	B	3.24								
T4-16	S	4.72								
	M									
	B	2.54								
T4-17	S	4.49						2032.5		
	M									
	B	0.88								
T5-0	S		7.4							
T5-6	S	4.70								
	M									
	B	4.60								
T5-10	S	5.36								
	M									
	B	3.29								
T5-12	S	5.32								
	M									
	B	3.10								
T5-16	S	5.14								
	M									
	B	2.54								
T5-17	S	4.39								
	M	3.76								

S= Surface M=Medium B=Bottom

Stations	Levels	Oxygen (ml/l-1)	pH	Suspended Solids mg/L	Total Nitrogen mg/L	Organic Nitrogen mg/L	Total Phosphor mg/L	Sulfates mg/L	Hardness mg/L	Chlorophyll mg/L
	B	1.60								
T6-0	S		7							
T6-6	S	5.17								
	M									
	B	4.70								
T6-10	S									
	M									
	B									
T6-16	S	5.09								
	M	4.39								
	B	2.45								
T7-0	S		7.1							
T7-6	S	4.76								
	M									
	B									
T7-10	S	5.13								
	M									
	B	4.07								
T7-16	S	2.38								
	M									
	B									
T8-0	S		7.4							
T8-6	S	5.26								
	M									
	B	4.05								
T8-10	S	5.92								
	M									
	B	4.05								
T8-17	S	4.30								
	M	3.76								
	B	0.94								
MDL				5	0.10	0.1	0.05		1	0.001

MDL= Method Detection Limit

Table 3-10. Pesticides analyzed at water samples in Spring 2002.

Stations	Levels	Lindano ng/l	Heptacloro ng/l	Aldrin ng/l	Dieldrin ng/l	Endrin ng/l	Endosulfan ng/l	Metoxicloro ng/l	p.p-DDE ng/l	p.p-DDD ng/l	p.p-DDT ng/l
T1-0	S	<0.2	<0.3	<0.2	<0.3	<0.4	<0.4	<0.4	<0.2	<0.2	<0.2
T1-17	S	<0.2	<0.3	<0.2	<0.3	<0.4	<0.4	<0.4	<0.2	<0.2	<0.2
MDL		0.2	0.3	0.2	0.3	0.4	0.4	0.4	0.2	0.2	0.2

MDL= Method Detection Limit S= Surface

Table 3-11. Parameter values of microbiological and Pollution in surface water samples. Spring 2002, Playa Melchorita

Stations	Levels	Totals Coliforms NMP/100ml	Thermotolerant Coliforms NMP/100ml	BOD mg/L
T1-0	S	2	2	1
T1-17	S	<2	<2	2
MDL		2	2	1

MDL= Method Detection Limit S= Surface

Table 3-12. Composition and abundance of macrobenthos species sampled at inter-tidal zone in Autumn 2002, Playa Melchorita

Species	T1				T2				T3				T4				T5				T6				T7			
	Z SEC	Z RET	Z RES	Z SAT	Z SEC	Z RET	Z RES	Z SAT	Z SEC	Z RET	Z RES	Z SAT	Z SEC	Z RET	Z RES	Z SAT	Z SEC	Z RET	Z RES	Z SAT	Z SEC	Z RET	Z RES	Z SAT	Z SEC	Z RET	Z RES	Z SAT
NEMERTINA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
SIPUNCULIDA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
POLYCHAETA																												
Nereido	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Glycera sp.	0	0	93	0	0	22	2	0	0	22	2	0	0	0	0	2	1	0	0	0	0	3	18	0	0	2	2	0
Hemipodus triannulatus	2	28	65	0	0	34	0	0	0	34	0	0	0	5	3	0	0	45	6	3	42	3	8	1	0	0	37	8
Poligordius sp?	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	30	0	0	0	0
MOLLUSCA																												
Donax marincovichi	0	0	0	0	0	1	0	0	0	1	0	0	0	0	1	3	0	0	0	1	0	0	0	3	0	0	0	0
CRUSTACEA																												
Excirollana brasilensis	19	4	0	0	21	1	0	0	21	1	0	0	0	32	0	0	149	11	0	0	14	14	0	0	27	12	28	0
Haustorius	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Emerita analoga	0	0	4	0	0	1	2	0	0	1	2	0	0	0	1	0	0	0	0	0	1	0	3	0	0	2	0	0
Caprelidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Calanus sp.	0	0	0	0	0	2	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0
Cyclops sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
INSECTA (larva)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Other Groups																												
Amphelisca sp1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	15	1	0	0	0	0	0	0	0	0	0	0	0
Amphelisca sp2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0
Average density (indv/m^2)	762	1190	6059	0	762	2268	149	0	762	2268	149	0	0	1357	186	892	5613	2119	216	186	2100	777	1074	1264	1041	595	2491	331
Total of species	2	2	4	0	1	6	2	0	1	6	2	0	0	2	3	5	3	3	1	3	3	4	3	3	2	3	3	2
Total of individuals	21	32	163	0	21	61	4	0	21	61	4	0	0	37	5	24	151	57	6	5	57	21	29	34	28	16	67	9
Richness of species	0.329	0.289	0.589	0.000	0.000	1.216	0.721	0.000	0.000	1.216	0.721	0.000	0.000	0.277	1.243	1.259	0.399	0.495	0.000	1.243	0.495	0.985	0.594	0.567	0.300	0.721	0.476	0.455
Pielou evenness	0.454	0.544	0.584	0.000	0.000	0.563	1.000	0.000	0.000	0.563	1.000	0.000	0.000	0.571	0.865	0.717	0.072	0.523	0.000	0.865	0.583	0.701	0.807	0.390	0.222	0.670	0.726	0.503
Diversity (bits/ind)	0.454	0.544	1.167	0.000	0.000	1.454	1.000	0.000	0.000	1.454	1.000	0.000	0.000	0.571	1.371	1.982	0.115	0.830	0.000	1.371	0.925	1.401	1.278	0.618	0.222	1.061	1.150	0.503

Table 3-13. Composition and abundance of macrobenthos species sampled at inter-tidal zone in Spring 2002, Playa Melchorita.

Species	T1				T2				T3				T4			
	Z SEC	Z RET	Z RES	Z SAT	Z SEC	Z RET	Z RES	Z SAT	Z SEC	Z RET	Z RES	Z SAT	Z SEC	Z RET	Z RES	Z SAT
TURBELLARIA	7	1	1	0	0	202	0	0	0	0	0	0	0	0	0	0
NEMATODA																
Nematodo	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Punctodora	519	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
POLYCHAETA																
Glycera sp.	2	416	22	16	3	54	9	678	5	9	2	19	3	759	25	4
Hemipodus triannulatus	0	0	4	0	0	8	0	0	0	0	0	0	0	0	0	0
Spionidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Magellona	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OLIGOCHAETA	0	0	0	258	0	0	0	0	0	0	0	0	0	0	0	0
INSECTA																
COLLEMBOLA																
Isotomidae	326	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CRUSTACEA																
Calanus sp.	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cumacea	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AMPHIPODA																
Amphelisca sp1	0	0	0	3	0	0	3	1	1	9	61	42	1	0	0	14
Amphelisca sp2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
ISOPODA																
Excirollana brasilensis	7	0	0	0	11	0	0	16	30	0	0	0	61	0	70	0
Emerita analoga	0	5	2	1	0	1	0	1	0	2	0	0	0	1	1	0
PAGURIDAE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MOLLUSCA																
Donax marincovichi	0	0	0	0	0	1	0	5	0	0	3	3	0	0	0	21
Semimytilus algosus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Average density (indv/m^2)	32193	15688	1078	10335	520	9888	446	26059	1338	743	2454	2379	2416	28253	3569	1636
Total of species	7	3	4	4	2	5	2	5	3	3	3	3	3	2	3	5
Total of individuals	866	422	29	278	14	266	12	701	36	20	66	64	65	760	96	44
Richness of species	0.887	0.331	0.891	0.533	0.379	0.716	0.402	0.611	0.558	0.668	0.477	0.481	0.479	0.151	0.438	1.060
Pielou evenness	0.411	0.074	0.565	0.218	0.750	0.423	0.811	0.107	0.479	0.864	0.291	0.710	0.242	0.014	0.572	0.750
Diversity (bits/ind)	1.154	0.117	1.130	0.437	0.750	0.981	0.811	0.249	0.758	1.369	0.461	1.126	0.383	0.014	0.906	1.741

Species	T5				T6				T7				T8			
	Z SEC	**Z RET**	**Z RES**	**Z SAT**	**Z SEC**	**Z RET**	**Z RES**	**Z SAT**	**Z SEC**	**Z RET**	**Z RES**	**Z SAT**	**Z SEC**	**Z RET**	**Z RES**	**Z SAT**
TURBELLARIA	0	0	0	0	2	420	0	0	0	0	54	0	0	0	6	2
NEMATODA																
Nematodo	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Punctodora	0	0	0	0	16	0	0	0	0	0	2	0	0	0	0	0
POLYCHAETA																
Glycera sp.	10	1070	15	1	3	43	44	13	19	37	32	3	2	19	1	14
Hemipodus triannulatus	0	0	0	0	0	7	0	0	0	0	6	0	0	2	0	0
Spionidae	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	2
Magellona	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
OLIGOCHAETA	0	0	0	0	0	0	0	0	9	11	0	0	0	0	0	0
INSECTA																
COLLEMBOLA																
Isotomidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CRUSTACEA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Calanus sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cumacea	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AMPHIPODA																
Amphelisca sp1	0	0	2	0	1	0	0	0	0	0	0	0	0	0	0	0
Amphelisca sp2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ISOPODA																
Excirollana brasilensis	9	0	0	0	38	0	0	0	18	19	0	0	52	0	0	0
Emerita analoga	0	1	1	0	0	3	4	1	0	8	187	76	0	0	0	2
PAGURIDAE	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
MOLLUSCA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Donax marincovichi	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	1
Semimytilus algosus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Average density (indv/m^2)	706	39814	669	37	2268	17621	1822	520	1710	2788	10520	2937	2007	781	260	818
Total of species	2	2	3	1	6	5	3	2	3	4	7	2	2	2	2	6
Total of individuals	19	1071	18	1	61	474	49	14	46	75	283	79	54	21	7	22
Richness of species	0.340	0.143	0.692	0.000	1.216	0.649	0.514	0.379	0.522	0.695	1.063	0.229	0.251	0.329	0.514	1.618
Pielou evenness	0.998	0.011	0.507	0.000	0.581	0.269	0.346	0.371	0.957	0.878	0.510	0.233	0.229	0.454	0.592	0.682
Diversity (bits/ind)	0.998	0.011	0.803	0.000	1.502	0.624	0.549	0.371	1.517	1.755	1.432	0.233	0.229	0.454	0.592	1.764

Table 3-14. Values of hydrographic and marine circulation parameters in surface, medium and bottom water samples. Autumn 2002. Playa Melchorita

S = Surface **M= Medium** **B= Bottom**

Stations	levels	Temperature (°C)	Salinity UPS	Direction of currents (°)	Velocity of currents (cm/s)
T1-0	S	18.5			
T1-6	S	18.4	35.018		
	M				
	B	16.6	35.045		
T1-10	S	18.4			
	M				
	B	16.5			
T1-17	S	18.2	35.024	302	15.83
	M	16.1	35.027		
	B	15.8	35.047	303	10.63
T2-0	S	18			
T2-6	S	18.2	35.019		
	M				
	B	16.7			
T2-10	S	18.1		297	22.3
	M				
	B	16.8		300	14.3
T2-12	S	18			
	M				
	B	16.6			
T2-16	S	18.2			
	M				
	B	15.6			
T2-17	S	18.2	34.993	283	4.9
	M				
	B	15.6	35.047	288	5.33
T3-0	S	16.6			
T3-6	S	17.8	35.018		
	M				
	B	16			
T3-10	S	18			
	M				
	B	16.1			
T3-12	S	18	34.998		
	M				
	B	16	35.046		
T3-16	S	18.1			
	M				
	B	15.6			
T3-17	S	18			
	M	16.1			
	B	15.6			

S = Surface **M= Medium** **B= Bottom**

Stations	levels	Temperature (°C)	Salinity UPS	Direction of currents (°)	Velocity of currents (cm/s)
T4-0	S	19			
T4-6	S	18.2	35.021		
	M				
	B	16.1			
T4-10	S	18.4			
	M				
	B	15.9			
T4-12	S	18.1	34.997		
	M				
	B	15.9	35.029		
T4-16	S	18.1		302	4.86
	M				
	B	15.8		260	8.78
T4-17	S	18.1	34.997		
	M				
	B	15.8	35.034		
T5-0	S	17			
T5-6	S	18.3	35.026		
	M				
	B	15.8			
T5-10	S	18		274	19.75
	M				
	B	15.9		319	15.69
T5-17	S	18.1	35.007		
	M	15.8			
	B	15.8	35.037		
T6-0	S	17.2			
T6-6	S				
	M				
	B				
T6-10	S	18.1			
	M				
	B	16			
T7-0	S	16.3			
T7-6	S	18.1	35.019	273	20.42
	M				
	B	15.6	35.045	291	9.94
T7-10	S	18.1			
	M				
	B	16	35.047		
T7-17	S	18.1	34.998		
	M	16.1			
	B	15.7	35.032		

Table 3-15. Values of hydrographic and marine circulation parameters in surface, medium and bottom water samples. Spring 2002. Playa Melchorita

S= Surface M= Medium B= Bottom

Stations	levels	Temperature (°C)	Salinity UPS	Direction of currents (°)	Velocity of currents (cm/s)
T1-0	S	16.0			
T1-6	S	18.7		121	13.69
	M				
	B	17.9		119	6.19
T1-10	S	18.0			
	M				
	B	17.3			
T1-17	S	17.7	34.978	175	13.23
	M	16.7	34.971		
	B	16.3	34.949	158	18.27
T2-0	S	16.0			
T2-6	S	18.2			
	M				
	B	17.4			
T2-10	S	17.7			
	M				
	B	17.1			
T2-12	S	17.9			
	M				
	B	17.1			
T2-16	S	17.5			
	M				
	B	16.6			
T2-17	S	17.7	34.992		
	M				
	B	16.6	34.955		
T3-0	S	17.0			
T3-6	S	18.1	34.930		
	M				
	B	17.8	34.943		
T3-10	S	18.0			
	M				
	B	17.3			
T3-12	S	17.8	34.927	131	23.51

S= Surface **M= Medium** **B= Bottom**

Stations	levels	Temperature (°C)	Salinity UPS	Direction of currents (°)	Velocity of currents (cm/s)
	M				
	B	16.9	34.938	273	47.23
T3-16	S	18.0			
	M				
	B	17.3			
T3-17	S	17.4			
	M	16.5			
	B	16.0			
T4-0	S	17.0			
T4-6	S	17.0		176	12.47
	M				
	B	16.9		131	18.34
T4-10	S	17.7			
	M				
	B	16.4			
T4-12	S	17.6	34.945		
	M				
	B	16.4	34.942		
T4-16	S	16.9	34.950		
	M				
	B	16.3	34.940		
T4-17	S	16.7	34.951	122	30.19
	M				
	B	15.5	34.943	150	16.21
T5-0	S	16.0			
T5-6	S	17.0	34.947		
	M				
	B	16.9			
T5-10	S	17.7	34.953		
	M				
	B	16.4	34.944		
T5-12	S	17.6	34.959	137	36
	M				
	B	16.4	34.943	130	31
T5-16	S	17.0			
	M				

S= Surface **M= Medium** **B= Bottom**

Stations	levels	Temperature (°C)	Salinity UPS	Direction of currents (°)	Velocity of currents (cm/s)
	B	16.3			
T5-17	S	16.7			
	M	16.1			
	B	15.6			
T6-0	S	16.5			
T6-6	S	17.0	34.940		
	M				
	B	16.9			
T6-10	S	17.5			
	M				
	B	16.5			
T6-16	S	16.9	34.955	126	28
	M	16.5	34.948		
	B	16.3	34.956	158	21
T7-0	S	17.5			
T7-6	S	17.0		273	20.42
	M				
	B	16.9		291	9.94
T7-10	S	17.4			
	M				
	B	16.7			
T7-16	S				
	M				
	B	15.9	34.943		
T8-0	S	16.5			
T8-6	S	17.4	34.938	93	9
	M				
	B	16.9	34.957	106	10
T8-10	S	17.3	34.962		
	M				
	B	16.7	34.944		
T8-16	S	16.6	34.933		
	M	16.5	34.940		
	B	15.4	34.951		

Table 3-16. Composition and abundance of phytoplankton, determined at different levels of depth. N° of cells/50 ml. Autumn 2002. Pampa Melchorita

S= Surface **M= Medium** **B= Bottom**

Station	T1-17			T1-10		T1-6	T3-17			T3-12		T3-6	T5-17			T5-10		T5-6	T7-17			T7-10		T7-6
Level	**S**	**M**	**B**	**S**	**B**	**S**	**S**	**M**	**B**	**S**	**B**	**S**	**S**	**M**	**B**	**S**	**B**	**S**	**S**	**M**	**B**	**S**	**M**	**S**
Diatoms																								
Actinocyclus octonarius	8	1	2	4	7	3	17	0	3	3	1	0	9	0	2	10	0	8	15	0	3	11	1	3
Achnanthes sp	0	0	0	0	0	0	17	0	0	41	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Amphiprora sp	21	2	9	5	12	7	21	2	7	23	1	5	17	5	1	19	2	9	23	10	6	9	10	4
Amphora sp	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0
Asterionellopsis glacialis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	0	0
Asteromphalus heptactis	0	2	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	5	2	0	0	0
Biddulphia alternans	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cerataulina pelagica	171	0	0	37	0	23	800	0	0	19	5	36	181	0	0	123	0	350	81	59	2	31	5	19
Coscinodiscus centralis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Coscinodiscus curvatulus	0	0	3	0	0	0	0	0	0	11	0	5	0	0	3	5	0	0	0	0	0	2	0	0
Coscinodiscus perforatus	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	1	0
Cylindrotheca closterium	800	21	7	500	8	825	1100	25	1	1125	18	325	1525	19	12	625	15	925	1225	140	10	725	11	500
Chaetoceros affinis	33	0	0	85	47	190	81	27	0	30	179	92	79	131	0	151	63	60	115	175	0	83	145	61
Chaetoceros constrictus	0	0	0	0	0	0	0	0	0	0	0	10	0	0	0	0	0	0	0	0	0	79	21	0
Chaetoceros curvisetus	0	51	10	0	0	0	27	437	81	384	361	163	0	218	459	121	727	18	69	1200	61	131	664	0
Chaetoceros danicus	0	0	0	0	0	2	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	2	0	0
Chaetoceros debilis	33	861	571	75	599	617	157	412	173	213	1807	905	67	259	794	327	1534	200	247	1700	209	425	2285	370
Chaetoceros didymus	2076	214	113	2050	720	3050	3550	267	109	2307	417	3900	3825	106	88	4600	581	2666	3425	1775	30	3150	437	1875
Chaetoceros lauderii	0	0	0	15	0	21	14	29	0	21	2	23	0	3	4	0	0	8	11	33	0	5	18	2
Chaetoceros lorenzianus	7	31	59	38	35	57	8	20	75	63	81	45	33	15	47	23	103	11	14	43	20	25	147	13

S= Surface **M= Medium** **B= Bottom**

Station	T1-17			T1-10		T1-6	T3-17			T3-12		T3-6	T5-17			T5-10		T5-6	T7-17			T7-10		T7-6
Level	**S**	**M**	**B**	**S**	**B**	**S**	**S**	**M**	**B**	**S**	**B**	**S**	**S**	**M**	**B**	**S**	**B**	**S**	**S**	**M**	**B**	**S**	**M**	**S**
Chaetoceros socialis	44	0	0	0	0	53	0	0	11	0	87	0	0	0	6	0	0	0	0	0	0	0	0	0
Chaetoceros sp	0	0	0	0	0	0	0	0	0	0	97	0	0	0	0	0	0	0	0	0	0	0	0	0
Ditylum brightwellii	1	0	0	0	0	2	0	0	0	7	1	3	0	0	0	0	0	0	2	1	0	3	1	1
Entomoneis alata	0	0	0	0	3	2	11	2	2	2	3	4	0	0	0	7	1	2	0	7	0	6	5	5
Eucampia zoodiacus	9	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	2	0	0	0	0	0
Fragilariopsis doliolus	30	0	0	0	0	0	23	0	0	8	0	0	3	0	0	0	0	0	0	0	0	0	0	4
Guinardia delicatula	3375	230	168	2700	183	1600	3200	321	73	2325	590	1575	4075	110	101	2350	71	2725	2100	2425	165	1975	228	1075
Leptocylindrus danicus	551	17	0	1350	81	1094	2250	0	0	950	90	461	875	0	0	2300	18	725	2225	248	0	1350	69	575
Lithodesmiun undulatum	8	25	13	15	128	12	3	9	21	24	101	2	14	6	8	31	93	0	20	63	0	35	33	0
Meuniera membranacea	11	0	0	17	0	9	0	0	0	0	0	0	64	0	0	23	0	0	24	26	0	41	5	9
Navicula sp	0	12	5	0	13	1	0	9	275	0	29	200	3	3	10	0	5	5	0	31	4	5	275	12
Odontella aurita	0	0	0	0	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	5	2
Pleurosigma normanii	0	2	176	0	293	1	1	9	125	31	205	47	0	14	41	10	260	0	18	83	36	20	452	8
Pseudonitzschia delicatissima	0	21	4	0	0	0	0	16	0	0	17	8	0	8	11	0	5	0	0	27	19	0	0	0
Rhizosolenia robusta	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Skeletonema costatum	30	0	0	1175	23	568	1975	0	13	1825	5	1225	4400	0	6	5725	83	1500	5950	750	12	4525	275	1450
Stephanopyxis turris	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0	0	2	0	0	0	0
Thalassionema nitzschioides	0	2	79	0	59	0	25	0	41	13	69	43	16	7	6	37	47	0	11	83	5	35	45	0
Thalassiosira anguste lineata	163	45	21	203	128	113	357	0	0	287	85	64	123	0	8	260	9	23	328	79	0	164	15	49
Thalassiosira mendiolana	50	15	0	0	0	0	8	9	0	114	0	11	0	0	0	0	0	0	0	0	0	0	0	0
Thalassiosira minima	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	2	0	0

S= Surface **M= Medium** **B= Bottom**

Station	T1-17			T1-10		T1-6	T3-17			T3-12		T3-6	T5-17			T5-10		T5-6	T7-17			T7-10		T7-6
Level	**S**	**M**	**B**	**S**	**B**	**S**	**S**	**M**	**B**	**S**	**B**	**S**	**S**	**M**	**B**	**S**	**B**	**S**	**S**	**M**	**B**	**S**	**M**	**S**
Thalassiosira rotula	40	26	29	52	26	112	288	46	11	127	90	63	144	79	1	215	38	32	119	81	25	89	18	20
Thalassiosira sp	0	0	0	127	7	44	0	0	0	0	15	11	139	0	0	236	2	93	159	48	0	147	48	77
Thalassiothrix longissima	1	2	0	1	0	0	0	0	2	1	2	1	0	0	0	0	0	3	0	4	0	3	1	1
TOTAL OF DIATOMS	7462	1580	1269	8450	2380	8406	13933	1640	1025	9956	4359	9229	15596	984	1608	17203	3664	9364	16183	9098	609	13087	5220	6135
Dinoflagellates																								
Amylax triacantha	0	0	0	3	0	3	8	0	0	0	0	0	2	0	0	0	0	3	0	0	0	0	0	0
Ceratium dens	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	2	0	1	5	0	0	3	0	0
Ceratium furca	750	127	0	1250	16	750	0	0	4	232	21	350	60	3	0	500	0	500	525	120	0	49	0	73
Ceratium fusus var fusus	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	3	0	0	0	0	0
Ceratium tripos	0	0	2	2	0	1	1	0	13	1	0	0	0	4	4	0	0	0	0	0	5	2	0	1
Cochlodinium sp	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dinophysis acuminata	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0
Dinophysis caudata	4	0	0	27	0	53	0	0	0	5	0	2	8	0	0	41	0	6	21	0	0	1	0	7
Dinophysis rotundata	1	0	0	5	0	2	5	2	0	2	0	0	2	0	0	1	0	1	0	2	0	0	0	0
Diplopelta asymmetrica	0	0	0	0	4	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0
Diplopeltopsis minor	13	4	2	5	0	24	23	5	0	11	0	5	84	0	3	5	0	0	15	1	0	8	2	4
Exuviaella marina	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	0	0
Glenodinium sp	0	0	0	600	0	275	127	0	0	0	0	0	450	0	0	175	0	125	75	0	25	425	0	700
Gonyaulax scrippsae	0	0	0	27	0	4	2	0	0	7	0	0	12	0	0	0	0	0	5	2	0	0	0	0
Gonyaulax spinifera	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Gymnodinium snguineum	1000	0	0	800	25	750	1	0	0	21	0	550	22	0	0	100	0	2025	350	1	0	336	0	1125
Gymnodinium sp	4400	0	0	5275	0	8550	6125	15	0	1275	0	488	9627	0	0	1800	0	4125	1050	100	75	300	0	1050

S= Surface M= Medium B= Bottom

Station	T1-17			T1-10		T1-6	T3-17			T3-12		T3-6	T5-17			T5-10		T5-6	T7-17			T7-10		T7-6
Level	**S**	**M**	**B**	**S**	**B**	**S**	**S**	**M**	**B**	**S**	**B**	**S**	**S**	**M**	**B**	**S**	**B**	**S**	**S**	**M**	**B**	**S**	**M**	**S**
Gyrodinium sp	43	1	0	35	0	55	29	0	5	15	0	3	33	0	0	49	0	17	41	0	0	37	0	5
Oxyphysis oxytoxoides	0	104	5	4	0	3	17	29	13	14	5	1	23	3	10	22	0	3	16	37	8	0	0	1
Podolampas palmipes	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polykrikos schwartzii	31	5	0	39	0	21	33	0	0	29	0	2	25	0	0	21	0	3	12	0	0	3	0	3
Pronoctiluca acuta	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	175	0	0	0	0	0	0
Prorocentrum gracile	350	0	0	1325	16	3025	49	0	0	60	0	2300	79	0	0	575	0	3175	425	5	0	1675	0	1225
Prorocentrum micans	0	0	0	0	0	2	0	0	0	1	0	0	0	0	0	1	0	3	2	0	0	2	0	1
Protoperidinium claudicans	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Protoperidinium conicum	0	0	0	0	0	0	2	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Protoperidinium crassipes	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Protoperidinium deficiens	0	0	0	0	0	0	0	9	0	0	0	1	1	1	1	0	0	0	0	0	0	0	0	0
Protoperidinium depressum	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Protoperidinium excentricus	2	0	0	1	0	5	3	0	5	3	0	0	0	0	0	0	0	0	1	6	0	0	0	0
Protoperidinium grani	2	0	0	1	0	2	6	0	0	5	0	0	12	0	0	2	0	0	2	0	0	0	0	2
Protoperidinium longispinum	0	5	0	5	0	2	9	3	0	4	0	0	1	3	0	5	0	0	0	22	0	0	0	0
Protoperidinium mendiolae	2	5	32	7	2	0	0	0	47	5	7	0	2	0	10	2	2	2	1	2	15	0	11	4
Protoperidinium minutum	1	0	0	33	1	60	7	1	0	73	0	0	5	2	0	9	0	7	27	0	0	2	0	2
Protoperidinium obtusum	4	0	0	0	0	0	0	0	0	0	0	0	1	0	0	2	0	1	7	0	0	0	0	0
Protoperidinium oceanicum	0	0	0	1	0	0	0	0	0	0	1	0	2	0	0	0	0	0	1	0	0	0	0	2
Protoperidinium pellucidum	5	2	0	8	0	0	16	0	0	8	0	0	18	0	2	1	0	0	3	0	0	3	0	1
Protoperidinium subinerme	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Pyrocystis lunula	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0

S= Surface M= Medium B= Bottom

Station	T1-17			T1-10		T1-6	T3-17			T3-12		T3-6	T5-17			T5-10		T5-6	T7-17			T7-10		T7-6
Level	**S**	**M**	**B**	**S**	**B**	**S**	**S**	**M**	**B**	**S**	**B**	**S**	**S**	**M**	**B**	**S**	**B**	**S**	**S**	**M**	**B**	**S**	**M**	**S**
Pyrophacus horologium	7	0	0	22	0	17	18	0	0	16	0	12	13	0	9	21	0	12	9	0	0	16	0	8
Scrippsiella trochoidea	0	0	0	12	0	13	9	3	2	1	0	5	200	0	0	11	0	9	10	3	0	15	0	7
TOTAL OF DINOFLAGELLATES	6620	253	41	9487	64	13622	6493	68	90	1791	35	3719	10682	17	42	3348	2	10194	2607	302	129	2977	13	4221
Silicoflagellates																								
Dictyocha fibula	9	30	196	5	221	81	45	190	290	39	725	33	1350	41	238	625	1725	35	1050	475	700	21	950	350
Dictyocha octonaria	0	0	7	0	3	0	0	0	4	0	2	0	0	0	2	1	0	1	0	3	0	0	0	0
TOTAL OF SILICOFLAGELLATES	9	30	203	5	224	81	45	190	294	39	727	33	1350	41	240	626	1725	36	1050	478	700	21	950	350
Phytoflagellates																								
Eutreptiella marina	325	8	5	52	16	98	500	2	2	100	17	25	400	10	9	39	18	475	350	33	5	11	0	0
Fitoflagellates	4775	1575	1650	13275	775	11300	23950	2775	625	2575	1075	1825	10400	25	25	5275	400	24975	4400	2050	25	6250	375	6950
Leucocryptos marina	475	0	0	2575	0	3175	300	0	0	3200	0	175	1825	0	0	1300	0	1775	1300	0	0	1275	0	1000
Pyramimona sp	0	0	0	0	0	0	625	0	0	0	0	0	1075	0	0	0	0	0	0	0	0	0	0	0
TOTAL OF PHYTOFLAGELLATES	5575	1583	1655	15902	791	14573	25375	2777	627	5875	1092	2025	13700	35	34	6614	418	27225	6050	2083	30	7536	375	7950
Total of species	43	30	24	46	29	50	48	28	31	54	36	43	48	26	32	50	25	45	50	43	25	51	31	45
Total of individuals	19666	3446	3168	33844	3459	36682	45846	4675	2036	17661	6213	15006	41328	1077	1924	27791	5809	46819	25890	11961	1468	23621	6558	18656
Richness of species	4.248	3.560	2.853	4.315	3.436	4.662	4.379	3.195	3.938	5.420	4.007	4.368	4.422	3.581	4.099	4.789	2.769	4.091	4.822	4.473	3.291	4.965	3.414	4.474
Pielou evenness	0.582	0.521	0.531	0.554	0.687	0.555	0.457	0.463	0.672	0.618	0.650	0.638	0.579	0.698	0.541	0.615	0.618	0.479	0.629	0.631	0.601	0.591	0.650	0.591
Diversity (bits/ind)	3.159	2.558	2.436	3.062	3.337	3.135	2.554	2.228	3.331	3.557	3.363	3.462	3.233	3.281	2.703	3.469	2.872	2.632	3.551	3.422	2.791	3.351	3.218	3.246

Table 3-17. Composition and abundance of other groups found in the phytoplankton samples at different levels of depth. N° of individuals/50 ml. Autumn 2002. Pampa Melchorita *

S= Surface **M= Medium** **B= Bottom**

Station	T1-17			T1-10		T1-6	T3-17			T3-12		T3-6	T5-17			T5-10		T5-6	T7-17			T7-10		T7-6
Level	**S**	**M**	**B**	**S**	**B**	**S**	**S**	**M**	**B**	**S**	**B**	**S**	**S**	**M**	**B**	**S**	**B**	**S**	**S**	**M**	**B**	**S**	**M**	**S**
Ciliates																								
Amphorella amphora	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Codonella sp	0	0	0	0	0	0	0	0	6	0	0	0	0	7	3	0	0	0	1	0	0	0	0	0
Eutintinnus lusus undae	0	3	3	27	23	65	9	0	0	11	1	27	7	0	3	20	2	31	10	8	0	19	12	31
Eutintinnus tubulosus	27	1	0	10	0	9	20	0	0	6	0	10	6	0	0	10	0	13	5	2	0	6	0	2
Favella serrata	0	0	1	2	0	1	1	2	0	0	0	1	2	0	0	1	0	2	1	0	0	4	0	1
Hellicostomella longa	34	0	0	35	0	39	22	0	0	37	0	16	15	3	0	10	1	5	2	0	0	1	0	9
Lohmmaniella oviformis	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Strombidium conicoides	0	0	0	21	0	12	7	0	0	29	0	0	3	0	0	3	0	0	0	10	0	56	0	5
Strombidium conicum	2	4	0	62	2	79	27	4	1	130	0	17	22	4	0	44	0	45	24	17	1	19	0	15
Strombidium sp	0	0	0	10	0	5	74	3	0	0	0	0	5	0	0	0	0	0	0	145	0	0	0	0
Strombidium strobilus	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0
Tiarina fusus	1	4	0	21	0	27	34	2	0	1	0	4	18	3	0	3	0	21	7	4	0	1	0	2
Tintinnopsis compressa	14	0	0	26	7	5	17	0	3	5	0	46	3	0	0	15	0	18	21	5	0	180	20	11
Tintinnopsis levigata	21	0	5	17	3	45	11	3	0	10	12	5	7	0	3	57	7	8	31	3	2	35	9	9
Total of ciliates	**99**	**12**	**9**	**231**	**35**	**287**	**227**	**18**	**10**	**230**	**13**	**126**	**88**	**17**	**9**	**163**	**10**	**148**	**102**	**194**	**3**	**321**	**41**	**85**
Zooplankton																								
Apendicularia	0	3	0	0	0	0	2	0	1	0	0	0	0	0	1	4	0	1	4	0	2	2	0	0
Copepods	0	1	0	0	1	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	2	1	0	0
Bivalve larvae	0	0	0	0	0	0	0	0	3	0	0	0	0	0	1	0	0	0	0	0	2	0	0	0
Invertebrate larvae?	0	2	0	10	0	7	0	0	0	5	0	1	5	0	0	4	0	1	4	1	0	1	0	0
Polychaete larvae	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Urochord Larva	0	0	0	0	0	0	0	0	0	1	0	0	2	0	0	0	0	0	0	0	0	0	0	0
Nematodes	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Nauplius	0	2	1	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	4	1	1	0	0	0
Total of zooplankton	**0**	**8**	**2**	**10**	**2**	**7**	**2**	**1**	**6**	**7**	**1**	**1**	**7**	**0**	**2**	**8**	**1**	**2**	**12**	**2**	**7**	**4**	**1**	**0**

* Diversity analyses was not performed

Table 3-18. Composition and abundance of zooplankton (individuals/sample) obtained at surface level, Autumn 2002. Pampa Melchorita

Station			T1-17	T1-6	T3-17	T3-10	T3-6	T5-17	T5-6	T6-10
Group/Order/Family	**Genus/Specie**	**Stage**								
HYDROIDOMEDUSAE										
Anthomedusae	Not determined		0	0	0	0	2	0	0	0
PELECYPODA	Not determined	Larvae	0	0	0	0	2	0	5	5
POLYCHAETA	Spionidae	Larvae	0	0	0	0	1	0	3	3
COPEPODA										
Calanoida	*Acartia tonsa*		671	57	64	29	113	22	1250	1000
	Centropages brachiatus		0	0	0	0	0	0	3	2
	Paracalanus parvus		4	0	0	1	0	3	0	0
Cyclopoida	*Oncaea* sp		1	0	0	0	0	0	0	0
	Calygus sp		0	0	0	0	1	0	0	0
	Not determined		0	0	0	0	4	0	4	3
CIRRIPEDIA	Not determined	nauplius	0	0	0	0	4	0	3	5
ISOPODA	Not determined		0	1	0	0	0	0	1	0
MYSIDACEA	Not determined		0	0	0	0	0	0	1	0
AMPHIPODA										
Caprellidae	Not determined		0	2	0	0	1	0	0	0
DECAPODA										
Anomura										
Hippidae	*Emerita analoga*	zoea	0	0	0	0	0	0	5	4
Macrura	*Callianassa* sp		0	0	0	0	0	0	2	1
Brachyura										
Grapsidae	Not determined	zoea	0	0	0	0	0	0	1	1
BRACHIOPODA	*Discinisca lamellosa*	larvae	0	0	0	0	8	0	11	3
APPENDICULARIA	*Oikopleura* sp		6	10	5	2	4	6	4	2
Total of species			4	4	2	3	10	3	13	11
Total of individuals			682	70	69	32	140	31	1293	1029
Richness of species			0.460	0.706	0.236	0.577	1.821	0.582	1.675	1.442
Pielou evenness			0.070	0.438	0.375	0.338	0.377	0.717	0.086	0.079
Diversity (bits/ind)			0.140	0.877	0.375	0.535	1.253	1.136	0.319	0.274

Table 3-19. Composition and abundance of icthyoplankton (individuals/sample). Autumn 2002. Pampa Melchorita*

Station			T1-17	T1-6	T3-17	T3-10	T3-6	T5-17	T5-6	T6-10
Family	**Specie**	**Phase**								
Engraulidae	*Engrailis ringens*	eggs	0	0	1	1	0	0	1	0
Atherinidae	Odontesthes regia regia	larvae	0	1	0	1	0	0		
Not determined		eggs	1	7	3	0	7	1	10	8

*Diversity analysis was not performed due to the scarce number of species

Table 3-20. Composition and abundance of macrobenthos species of the sub-tidal zone – Autumn 2002. Playa Melchorita

Transect	T1			T2				T3				T4					T5		T6	T7	
Station	**6 m**	**10 m**	**17 m**	**6 m**	**10 m**	**16 m**	**17 m**	**6 m**	**10 m**	**12 m**	**16 m**	**6 m**	**10 m**	**12 m**	**16 m**	**17 m**	**6 m**	**17 m**	**10 m**	**6 m**	**17 m**
ACTINIA	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	52	0
ECHINODERMATA																					
Ophiuroideo	9	0	0	20	0	0	0	7	1	0	1	10	0	1	0	0	25	7	1	0	0
PLATYHELMINTHES																					
TURBELLARIA	0	0	0	0	0	0	0	16	0	0	1	0	0	0	0	0	1	0	0	38	0
NEMERTEA	0	0	2	0	0	0	1	0	0	0	0	0	0	0	0	0	1	1	0	1	0
ANELLIDA																					
POLICHAETA																					
Magelona	0	1	100	1	1	4	62	0	0	0	1	0	0	0	2	0	0	112	0	0	4
SPIONIDAE																					
Polydora	16	9	0	0	0	0	0	0	0	0	0	1	0	0	0	0	7	0	0	24	0
ONUPHIDAE																					
Diopatra rhizoicola	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0
Diopatra sp	0	1	1	0	0	1	1	0	0	0	2	0	0	0	1	1	0	1	0	0	1
Nothria sp.	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
FLABELLIGERIDAE																					
Pherusa sp	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1	1	0	2	2	2	1
SILLIDAE																					
Syllis sp	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	10	0
PHYLLODOCIDAE																					
Eteone	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	91	0
SABELLIDAE	1	1	6	0	0	0	3	0	0	0	0	0	1	0	0	0	0	1	0	0	0
POLYNOIDAE																					
Halosydna	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0

Transect	T1			T2				T3				T4					T5		T6	T7	
Station	**6 m**	**10 m**	**17 m**	**6 m**	**10 m**	**16 m**	**17 m**	**6 m**	**10 m**	**12 m**	**16 m**	**6 m**	**10 m**	**12 m**	**16 m**	**17 m**	**6 m**	**17 m**	**10 m**	**6 m**	**17 m**
COSSURIDAE																					
Cossura sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
NEREIDAE																					
Nereis sp	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	59	0
Nephtys impressa	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Nephtys ferruginea	6	1	14	0	0	0	7	0	1	0	0	0	1	0	0	0	0	5	0	0	8
Sigambra bassi	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Hemipodus triannulatus	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Parendalia fauvelli	0	0	2	0	0	1	6	0	0	0	0	0	0	0	0	0	0	3	0	0	2
Fragmatopoma sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Leitoscolopos chilensis	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polichaete sp 15	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
APISTOBRANCHIDAE	9	0	0	3	1	0	0	5	0	0	0	2	1	0	0	0	1	0	0	0	0
Polichaete sp 21	16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polichaete sp 27	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SIPUNCULIDA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	73	0
MOLLUSCA																					
Chaetopleura	0	0	0	0	0	0	0	0	0	0	0	0	0	17	0	0	0	0	0	0	0
Diloma sp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0
Thais chocolata	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0
Nassarius gayi	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0
Prisogaster niger	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Natica undata?	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Dulina	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mitrella sp	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Transect	T1			T2				T3				T4					T5		T6	T7	
Station	**6 m**	**10 m**	**17 m**	**6 m**	**10 m**	**16 m**	**17 m**	**6 m**	**10 m**	**12 m**	**16 m**	**6 m**	**10 m**	**12 m**	**16 m**	**17 m**	**6 m**	**17 m**	**10 m**	**6 m**	**17 m**
Xanthochorus buxea	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0
Cinum cymba	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Donax marincovinchi	1	0	0	1	0	0	0	799	0	0	0	474	0	0	0	0	3255	0	0	10	0
Semmimitylus algosus	16	0	0	4	1	0	0	3	1	0	0	0	0	0	0	0	18	0	0	883	0
Mulina edulis	255	1480	148	5	174	10	23	2	59	16	33	0	45	5	3	3	1	40	38	574	64
ARTHROPODA																					
CRUSTACEA																					
Balanus laevis	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	744	0
Caprelidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	14	0
Isopheles pacificus	0	0	0	5	0	0	0	2	0	0	0	1	0	0	0	0	0	0	0	0	0
Excirolana braziliensis	1	0	0	0	0	0	0	8	2	0	0	0	1	0	0	0	0	0	3	0	0
Haustorius sp	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	20	0	0	0	0
Amphipode sp 3	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Cumacea	2	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	11	0	0	0	0
Undetermined Isopode 2	1	0	0	1	0	0	0	1	0	0	0	1	0	0	0	0	3	0	0	0	0
Undetermined Isopode 1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	1	0
Dinamenela vacheri	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Pignogonide	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PHORONIDA	1	0	5	0	0	0	2	0	0	0	0	0	1	0	0	0	0	30	0	3	0
Density (indv/m^2)	339	1492	276	40	178	16	103	842	64	16	37	487	49	32	7	5	3346	202	43	2579	80
Total of species	23	8	8	10	7	4	8	12	8	1	6	6	8	8	4	3	13	12	4	18	8
Total of individuals	345	1495	278	42	180	16	105	846	67	16	39	489	52	33	6	5	3349	204	44	2584	82
Richness of species	3.765	0.958	1.244	2.408	1.155	1.082	1.504	1.632	1.665	0.000	1.365	0.807	1.772	2.002	1.603	1.243	1.478	2.068	0.793	2.164	1.588
Pielou evenness	0.385	0.034	0.529	0.746	0.106	0.712	0.603	0.130	0.285	0.000	0.374	0.095	0.316	0.754	0.917	0.865	0.071	0.553	0.387	0.572	0.420
Diversity (bits/indv)	1.743	0.101	1.587	2.478	0.297	1.424	1.808	0.467	0.856	0.000	0.958	0.246	0.948	2.261	1.834	1.371	0.264	1.984	0.774	2.384	1.260

Table 3-21. Composition and abundance of phytoplankton, determined at different levels of depth. N° of cells/50 ml. Spring 2002. Playa Melchorita

S= Surface M= Medium B= Bottom

Station	T1-6	T1-10		T1-17			T3-6	T3-10	T3-12		T3-17			T5-6	T5-10	T5-12		T5-17			T6-6	T6-10		T6-16			T8-6	T8-10		T8-16		
Level	**S**	**S**	**B**	**S**	**M**	**B**	**S**	**S**	**S**	**B**	**S**	**M**	**B**	**B**	**S**	**S**	**B**	**S**	**M**	**B**	**S**	**S**	**B**	**S**	**M**	**B**	**S**	**S**	**B**	**S**	**M**	**B**
Diatoms:																																
Actinocyclus octonarius	3	24	2	44	56	7	32	0	1	40	1	0	5	0	4	3	16	0	0	0	4	0	0	5	5	41	4	0	0	8	8	29
Actinoptychus sp	0	0	1	0	0	0	0	0	0	0	0	0	2	3	0	0	0	1	4	1	5	0	2	0	0	0	1	1	1	2	0	0
Amphiprora sp	0	4	0	12	20	0	0	0	0	40	0	0	1	4	0	2	2	3	0	0	2	1	0	11	5	5	1	1	3	5	15	8
Amphora sp	15	272	45	0	3900	2525	88	17	99	620	10650	5675	3525	750	5	7	825	206	161	1450	62	21	1625	317	700	625	28	81	45	425	900	901
Asteromphalus heptactis	0	8	0	16	0	0	4	0	0	12	0	0	0	1	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	3	3
Asteromphalus brokei	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0
Ceratulina pelagica	0	4	0	56	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11	0	2	0	0	0	0	0
Corethron hystrix	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Coscinodiscus centralis	0	0	3	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Coscinodiscus curvatulus	0	0	5	0	0	0	0	0	0	0	0	0	0	11	7	0	3	0	0	0	2	0	0	3	5	5	3	0	0	5	15	7
Coscinodiscus perforatus	35	60	6	16	20	15	28	22	19	48	7	8	28	21	5	7	11	6	11	16	19	13	17	5	5	3	2	4	8	11	3	7
Coscinodiscus radiatus	0	8	0	12	12	0	4	0	0	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coscinodiscus sp	0	8	0	4	0	0	4	0	0	48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11
Cyclotella sp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	0	4	0	0	0	0	0	12
Cylindrotheca closterium	0	32	7	120	208	0	4	0	0	48	0	35	7	9	7	300	0	18	0	0	0	0	0	225	65	41	5	5	1	23	53	41
Chaetoceros affinis	0	124	0	0	44	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0
Chaetoceros anastomosans	0	0	0	0	0	0	28	0	0	276	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chaetoceros compressus	0	0	0	48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chaetoceros constrictus	21	36	0	0	12	0	0	32	0	0	6	11	18	0	0	0	0	9	0	0	0	0	0	0	0	0	0	5	0	0	0	0
Chaetoceros convolutus	0	0	0	12	36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chaetoceros curvisetus	48	0	0	12	0	0	0	0	0	0	0	28	0	0	0	0	0	0	0	0	0	0	0	0	0	57	0	0	0	0	14	0
Chaetoceros danicus	0	0	0	16	20	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chaetoceros debilis	0	0	0	76	0	0	0	0	0	260	0	0	0	36	0	0	0	0	139	0	238	0	0	43	30	0	0	0	0	0	0	0

S= Surface M= Medium B= Bottom

Station	T1-6	T1-10		T1-17			T3-6	T3-10	T3-12		T3-17			T5-6	T5-10	T5-12		T5-17			T6-6	T6-10		T6-16			T8-6	T8-10		T8-16		
Level	**S**	**S**	**B**	**S**	**M**	**B**	**S**	**S**	**S**	**B**	**S**	**M**	**B**	**B**	**S**	**S**	**B**	**S**	**M**	**B**	**S**	**S**	**B**	**S**	**M**	**B**	**S**	**S**	**B**	**S**	**M**	**B**
Chaetoceros didymus	8	0	0	0	0	0	0	0	0	260	0	0	0	18	0	0	0	0	0	0	63	0	0	0	21	0	0	0	0	0	0	0
Chaetoceros gracilis	0	0	0	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chaetoceros lauderi	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0
Chaetoceros lorenzianus	0	64	36	168	192	5	16	8	5	40	0	8	6	43	0	0	7	0	0	0	39	0	0	99	14	14	0	0	0	0	21	0
Chaetoceros peruvianus	0	0	0	8	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chaetoceros socialis	0	128	0	364	0	0	28	0	12	0	0	0	0	27	0	8	0	0	0	0	0	0	6	0	0	0	0	0	0	0	0	0
Chaetoceros sp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	207	0	0	59	177	15	14	15	0	108	100	42
Dactyliosolen fragilissimus	0	0	0	0	0	0	0	0	0	0	1550	18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Detonula pumila	0	16	0	0	140	0	0	0	0	56	0	0	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	20	0	0	0
Ditylum brightwellii	152	532	59	328	436	74	252	79	152	424	108	232	197	400	29	49	450	329	204	57	201	54	148	270	335	197	70	92	103	240	372	262
Entomoneis alata	4	56	26	136	124	12	32	4	14	144	25	35	39	43	31	6	350	36	14	20	11	12	0	144	209	121	19	8	12	149	247	120
Eucampia zoodiacus	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	6	0	0	0	0	0	0
Fragilariopsis doliolus	10	32	0	28	16	0	36	6	0	0	6	18	0	8	0	0	3	10	15	6	0	12	10	17	11	0	0	17	0	7	9	0
Guinardia delicatula	1150	740	75	0	1850	1600	632	141	200	1332	12700	4075	1425	245	0	0	1575	1800	1200	29	241	20	61	335	361	284	42	69	20	1075	476	73
Guinardia striata	54	208	45	0	524	1000	36	21	65	276	12450	168	63	60	7	0	49	120	67	37	105	21	21	92	120	49	38	101	62	375	49	49
Lauderia annulata	26	0	14	132	0	0	0	38	0	0	0	0	0	19	6	0	14	0	0	4	15	0	0	27	15	4	20	8	0	18	6	0
Leptocylindrus danicus	8	512	35	0	160	23	120	0	75	152	9100	1375	23	900	13	23	0	41	0	24	94	17	19	457	229	135	68	51	32	239	245	27
Lioloma delicatulum	0	0	0	12	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lioloma pacificum	0	0	0	20	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lithodesmium undulatum	0	0	0	0	0	8	0	0	0	0	0	0	0	0	0	0	6	0	8	4	0	0	0	0	0	0	0	0	0	0	0	0
Navicula sp	25	4	57	0	250	200	4	100	0	16	250	25	175	5	3	5	375	0	0	50	0	0	25	0	175	8	0	50	200	0	125	5
Odontella aurita	0	0	2	0	0	0	0	0	0	0	0	0	0	2	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Planktoniella sol	0	0	0	8	0	0	0	0	0	0	0	2	0	0	0	0	0	0	1	2	0	0	0	0	0	0	0	1	0	0	0	1
Pleurosigma normanii	13	0	53	0	0	900	0	27	26	0	15	93	486	57	30	35	1025	216	293	418	71	52	2050	91	151	188	31	10	243	131	209	370
Pleurosigma sp.	0	16	0	12	76	0	36	0	0	244	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

S= Surface M= Medium B= Bottom

Station	T1-6	T1-10		T1-17			T3-6	T3-10	T3-12		T3-17			T5-6	T5-10	T5-12		T5-17			T6-6	T6-10		T6-16			T8-6	T8-10		T8-16		
Level	**S**	**S**	**B**	**S**	**M**	**B**	**S**	**S**	**S**	**B**	**S**	**M**	**B**	**B**	**S**	**S**	**B**	**S**	**M**	**B**	**S**	**S**	**B**	**S**	**M**	**B**	**S**	**S**	**B**	**S**	**M**	**B**
Pseudonitzschia delicatissima	0	16	0	24	524	0	32	0	0	0	7050	1625	725	9	0	0	0	0	0	0	0	0	0	23	0	5	0	0	0	0	16	0
Pseudonitzschia lineola	4	0	0	0	0	0	0	0	0	0	15	6	5	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0
Pseudonitzschia pacifica	0	0	0	0	60	0	0	0	0	32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pseudonitzschia pungens	0	0	0	16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pseudonitzschia sp.	0	0	0	208	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhyzosolenia bergonii	0	0	0	8	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhizosolenia chunii	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Rhizosolenia robusta	0	0	0	4	4	1	4	0	0	0	2	1	1	0	0	0	1	0	1	1	0	1	0	0	0	1	0	4	0	0	1	3
Rhizosolenia stylirostris	0	16	0	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Skeletonema costatum	750	140	0	0	100	3075	150	825	0	548	2100	4875	2650	35	0	18	2175	1475	1125	1375	122	0	2050	1500	625	123	53	0	5	73	66	4950
Stephanopyxis turris	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Stephanopyxis palmeriana	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0	0	0	0	0	0	0	0	0
Surirella fastuosa	0	0	0	0	4	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Thalassionema bacillaris	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	0	0	0	0	0	0	0	0
Thalassionema frauenfeldii	0	0	0	24	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Thalassionema nitzschioides	0	32	0	124	32	20	0	12	6	60	47	31	12	5	13	0	17	15	8	20	0	2	4	6	6	0	2	0	0	5	5	44
Thalassiosira angulata	36	24	9	0	0	101	0	21	26	0	29	71	51	20	5	9	21	47	19	32	6	35	103	8	10	14	0	55	102	19	47	30
Thalassiosira anguste lineata	0	96	22	204	464	0	56	8	25	236	11	36	82	231	22	65	311	78	85	14	60	0	11	425	496	291	85	16	20	1000	390	288
Thalassiosira mendiolana	0	0	0	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	30	0	0	0	0	0	0	0
Thalassiosira rotula	4	0	0	0	0	27	0	32	58	0	50	64	14	77	0	0	0	45	14	24	13	0	42	5	9	10	0	5	45	38	15	0
Thalassiosira subtilis	0	124	0	36	80	0	16	0	0	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0
Thalassiosira sp	0	92	0	32	80	0	40	0	0	92	0	0	0	0	0	0	5	0	0	0	0	0	0	2	2	0	0	0	0	0	0	40
Thalassiothrix longissima	0	0	0	4	8	1	0	0	0	4	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0
Pennate	0	12	0	8	88	0	0	0	0	28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL OF DIATOMS	2369	3440	502	2396	9572	9594	1686	1393	783	5380	56172	18517	9551	3045	187	537	7243	4455	3375	3585	1580	266	6200	4188	3823	2246	489	599	924	3956	3421	7324

(....Continue) Table 3-21. Composition and abundance of phytoplankton, determined at different levels of depth. N° of cells/50 ml.. . Playa Melchorita, Spring 2002.

S= Surface M= Medium B= Bottom

Station	T1-6	T1-10		T1-17			T3-6	T3-10	T3-12		T3-17			T5-6	T5-10	T5-12		T5-17			T6-6	T6-10		T6-16			T8-6	T8-10		T8-16		
Level	**S**	**S**	**B**	**S**	**M**	**B**	**S**	**S**	**S**	**B**	**S**	**M**	**B**	**B**	**S**	**S**	**B**	**S**	**M**	**B**	**S**	**S**	**B**	**S**	**M**	**B**	**S**	**S**	**B**	**S**	**M**	**B**
Dinoflagellates:																																
Amylax triacantha	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	3	0	0	1	0	0	1	0	0	0	0	0	0	0
Ceratium azoricum	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0	1	1	1	0	0	0	0	0	2	0	0	0	0	0	0	0
Ceratium buceros	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ceratium dens	0	0	0	0	4	0	0	1	1	0	0	0	0	0	5	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0
Ceratium furca	7	8	3	0	40	1	248	32	8	0	1	20	0	49	39	21	8	8	97	26	69	78	2	27	105	65	17	10	9	27	150	0
Ceratium kofoidii	1	0	0	0	0	0	0	0	1	0	1	1	0	2	0	0	0	0	0	0	8	0	0	0	0	0	0	0	0	0	0	0
Ceratium pentagonum	0	0	0	4	4	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ceratium tripos	0	0	0	0	0	1	0	2	0	0	4	1	1	0	2	0	7	0	1	1	0	0	0	1	0	3	0	1	0	0	4	0
Dinophysis acuminata	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Dinophysis caudata	1	0	1	0	0	0	8	4	1	0	0	0	0	0	2	3	0	0	2	3	1	3	1	0	5	1	1	1	2	2	0	0
Dinophysis rotundata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Dissodinium asymmetrica	1	4	0	0	0	0	16	0	0	0	1	0	0	8	0	0	2	0	0	0	0	0	0	0	0	9	0	0	0	2	3	1
Dissodinium elegans	0	20	0	24	40	0	32	0	0	24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Diplopelta steini	1	0	0	0	0	0	0	10	3	0	0	6	0	0	0	0	0	4	10	2	0	0	1	0	0	0	0	0	1	0	0	0
Diplopeltopsis minor	0	4	0	0	16	0	20	0	0	12	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	1	0	0	10	3	0
Exuviaella marina	375	0	0	0	0	75	0	200	150	0	0	0	0	125	2175	450	0	0	0	75	0	75	0	200	150	0	0	1	0	5	0	0
Gonyaulax polygramma	2	0	0	0	0	0	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gonyaulax spinifera	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	9	0	0	8	0	0	0	2	0	9	5	0
Gonyaulax polygramma	0	0	0	0	4	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

S= Surface M= Medium B= Bottom

Station	T1-6	T1-10		T1-17			T3-6	T3-10	T3-12		T3-17			T5-6	T5-10	T5-12		T5-17			T6-6	T6-10		T6-16			T8-6	T8-10		T8-16		
Level	**S**	**S**	**B**	**S**	**M**	**B**	**S**	**S**	**S**	**B**	**S**	**M**	**B**	**B**	**S**	**S**	**B**	**S**	**M**	**B**	**S**	**S**	**B**	**S**	**M**	**B**	**S**	**S**	**B**	**S**	**M**	**B**
Gymnodinium sanguineum	16	4	0	0	0	0	8	16	9	4	0	2	0	16	4275	1750	0	13	0	0	8	35	0	15	1400	141	1175	0	3	25	299	0
Gymnodinium sp	0	0	1125	0	0	0	50	0	0	0	0	0	0	1125	2600	0	0	0	0	0	1975	0	0	0	1375	100	0	0	0	0	375	0
Gyrodinium lachryma	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gyrodinium sp	0	0	0	0	0	0	0	0	0	0	0	11	0	0	0	0	0	0	4	0	5	3	0	0	1	3	0	0	0	0	13	0
Oxyphysis oxytoxoides	0	0	3	0	4	0	32	5	0	8	0	1	0	2	53	275	5	2	5	10	12	29	4	1	10	19	18	4	1	11	7	0
Prorocentrum gracile	0	596	65	20	212	5	4900	3925	72	56	15	33	5	700	6625	8175	37	270	975	47	2175	9900	43	1875	1475	265	2350	4450	1650	2250	1600	21
Prorocentrum micans	31	16	16	0	20	8	60	56	84	8	8	17	0	11	81	75	58	14	85	19	31	121	69	5	59	139	19	1	21	21	111	1
Protoperidinium claudicans	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Protoperidinium conicum	0	0	0	0	4	0	4	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	2	0	4
Protoperidinium crassipes	0	0	0	0	4	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0
Protoperidinium depressum	4	8	1	0	0	0	16	7	11	4	0	1	0	3	1	0	1	0	1	3	3	9	0	1	5	6	1	1	1	2	3	0
Protoperidinium divergens	1	0	0	0	4	0	0	1	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0
Protoperidinium excentricum	0	0	0	0	0	0	4	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	3	0	13	3	0	0	10	2	2
Protoperidinium granii	2	0	0	0	0	2	0	0	1	0	0	0	0	3	10	5	0	0	3	12	6	0	1	12	13	30	1	2	2	10	24	1
Protoperidinium leonis	0	0	0	0	12	0	4	1	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Protoperidinium longipes	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Protoperidinium	0	0	0	0	0	0	0	0	0	4	0	0	0	1	1	0	0	0	0	1	5	2	0	0	0	3	0	0	0	0	8	5

S= Surface M= Medium B= Bottom

Station	T1-6	T1-10		T1-17			T3-6	T3-10	T3-12		T3-17			T5-6	T5-10	T5-12		T5-17			T6-6	T6-10		T6-16			T8-6	T8-10		T8-16		
Level	**S**	**S**	**B**	**S**	**M**	**B**	**S**	**S**	**S**	**B**	**S**	**M**	**B**	**B**	**S**	**S**	**B**	**S**	**M**	**B**	**S**	**S**	**B**	**S**	**M**	**B**	**S**	**S**	**B**	**S**	**M**	**B**
longispinum																																
Protoperidinium mendiolae	0	0	1	0	12	1	0	0	0	12	1	1	0	2	15	5	21	0	2	2	0	1	0	1	10	38	2	5	5	15	19	31
Protoperidinium minutum	0	0	0	0	20	0	0	0	0	0	0	1	0	0	0	0	0	0	4	9	0	4	1	0	8	5	0	0	0	5	11	85
Protoperidinium obtusum	0	0	0	0	8	0	8	0	0	0	0	0	0	1	5	0	0	0	2	0	2	0	1	0	1	2	1	0	0	2	1	0
Protoperidinium oceanicum	0	0	0	0	4	0	0	1	0	0	4	3	0	2	0	0	0	2	1	0	3	0	0	0	1	0	0	2	0	1	0	0
Protoperidinium pellucidum	2	0	0	0	4	1	16	1	0	0	1	1	2	6	15	5	2	0	2	17	2	6	1	2	0	16	4	2	1	9	2	3
Protoperidinium pentagonum	0	0	0	0	4	0	8	3	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	1	2	0	0	0	1	0	1	0
Protoperidinium steinii	0	0	0	0	20	0	4	0	0	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Protoperidinium subinerme	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Protoperidinium sp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Pyrocystis lunula	9	0	3	0	0	4	0	8	10	0	5	16	12	11	3	2	30	28	13	132	15	4	7	47	35	35	11	1	4	59	45	35
Pyrophacus horologicum	0	0	8	0	0	0	0	0	0	0	0	0	0	30	11	12	7	0	0	0	36	0	0	25	29	13	8	0	0	16	27	3
Scrippsiella trochoidea	3	28	0	0		0	60	0	1	4	0	1	0	0	3	11	0	10	5	3	9	1	0	18	8	1	0	4	0	27	53	1
TOTAL OF DINOFLAGELLATES	456	688	1226	48	440	99	5514	4273	352	156	44	123	21	2098	15922	10790	180	353	1219	363	4374	10276	131	2245	4696	910	3612	4487	1701	2520	2770	195
Silicoflagellates:																																
Dictyocha fibula	4	4	19	28	0	42	4	0	8	28	0	13	12	7	3	7	61	1	14	2	0	5	17	3	0	5	5	0	4	0	0	25
Dictyocha octonaria	0	0	3	0	4	3	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

S= Surface M= Medium B= Bottom

Station	T1-6	T1-10		T1-17			T3-6	T3-10	T3-12		T3-17			T5-6	T5-10	T5-12		T5-17			T6-6	T6-10		T6-16			T8-6	T8-10		T8-16		
Level	**S**	**S**	**B**	**S**	**M**	**B**	**S**	**S**	**S**	**B**	**S**	**M**	**B**	**B**	**S**	**S**	**B**	**S**	**M**	**B**	**S**	**S**	**B**	**S**	**M**	**B**	**S**	**S**	**B**	**S**	**M**	**B**
TOTAL OF SILICOFLAGELLATES	4	4	22	28	4	45	4	0	8	28	0	13	13	7	3	8	61	1	14	2	0	5	17	3	0	5	5	0	4	0	0	25
Cocolitoforidos:																																
Anoplosolenia brasiliensis	0	0	0	0	50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Emiliania huxleyi	0	2000	0	250	650	0	1250	0	0	800	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL OF COCOLITOFORIDOS	0	2000	0	250	700	0	1250	0	0	800	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Phytoflagellates																																
Leucocryptos marina	800	0	0	0	0	200	0	2200	550	0	2500	375	275	0	1150	425	0	325	350	200	575	2200	375	2575	1775	600	575	800	64	575	775	0
Monadas	18625	4850	0	0	56	0	2900	5475	2700	850	8550	4725	3425	1975	750	1125	0	1975	1850	1500	350	1625	2225	0	200	0	125	2900	2600	125	425	0
Eutreptiella gymnastica	0	160	0	0	250	0	660	0	0	50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Eutreptiella sp	1500	0	23	0	0	0	0	600	17		0	0	0	575	1000	1900	150	7	5	0	1200	900	0	500	54	8	70	169	0	101	73	1
Fitoflagelado (N.I).	9500	1900	1550	0	0	650	450	2200	850	0	3600	1025	675	5650	7250	4625	325	775	1225	525	15550	1825	775	27625	16250	5350	1275	1900	1050	9400	8025	525
TOTAL OF PHYTOFLAGELLATES	30425	6910	1573	0	306	850	4010	10475	4117	900	14650	6125	4375	8200	10150	8075	475	3082	3430	2225	17675	6550	3375	30700	18279	5958	2045	5769	3714	10201	9298	526
Total of species	40	45	33	45	61	32	52	38	33	46	37	49	35	52	40	34	38	34	47	42	44	39	32	49	54	52	40	40	36	47	57	42
Total of individuals	33254	13042	3323	2722	11022	10588	12464	16141	5260	7264	70866	24778	13960	13350	26262	19410	7959	7891	8038	6175	23629	17097	9723	37136	26798	9119	6151	10855	6343	16677	15489	8070
Richness of species	3.746	4.643	3.946	5.563	6.446	3.345	5.408	3.819	3.735	5.061	3.223	4.744	3.562	5.369	3.833	3.342	4.119	3.678	5.116	4.697	4.270	3.899	3.376	4.562	5.198	5.593	4.470	4.197	3.998	4.732	5.804	4.558
Pielou evenness	0.346	0.583	0.459	0.803	0.614	0.568	0.519	0.507	0.514	0.747	0.599	0.527	0.570	0.529	0.519	0.494	0.615	0.609	0.593	0.563	0.375	0.389	0.564	0.302	0.434	0.475	0.502	0.434	0.479	0.449	0.508	0.428
Diversity (bits/indv)	1.843	3.204	2.315	4.411	3.642	2.842	2.958	2.659	2.590	4.124	3.121	2.959	2.923	3.016	2.760	2.512	3.227	3.096	3.295	3.036	2.049	2.057	2.819	1.696	2.499	2.707	2.671	2.311	2.478	2.492	2.965	2.308

Table 3-22. Composition and abundance of other groups found in the phytoplankton samples at different levels of depth. N° of individuals/50 ml. Spring 2002. Pampa Melchorita *

S=Surface M=Medium B=Bottom

Station	T1-6	T1-10		T1-17			T3-6	T3-10	T3-12		T3-17			T5-6	T5-10	T5-12		T5-17			T6-6	T6-10		T6-16			T8-6	T8-10		T8-16		
Level	**S**	**S**	**B**	**S**	**M**	**B**	**S**	**S**	**S**	**B**	**S**	**M**	**B**	**B**	**S**	**S**	**B**	**S**	**M**	**B**	**S**	**S**	**B**	**S**	**M**	**B**	**S**	**S**	**B**	**S**	**M**	**B**
Ciliates																																
Amphorides amphora	18	0	5	0	0	1	0	5	11	0	2	7	5	33	5	30	22	0	0	9	35	14	4	62	85	48	0	5	0	73	100	29
Climacocylis scalaroides	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Eutintinnus tubulosus	47	0	18	0	0	5	0	45	33	0	0	0	9	36	52	33	40	11	7	9	45	0	9	33	60	29	0	55	22	15	58	17
Favella serrata	2	0	2	0	0	0	0	4	4	0	0	0	0	7	19	29	0	5	7	1	7	0	1	11	14	5	0	5	3	1	6	0
Helicostomella longa	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	3	1	0	0	0	4	3	0
Hellicostomella subulata	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Laboea emergens	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lohmanniella oviformis	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Strombidium conicoides	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0
Strombidium conicum	0	0	0	0	0	0	8	0	0	4	0	0	0	0	0	2	0	0	0	0	0	0	0	1	0	2	0	0	0	0	0	0
Tiarina fusus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	18	7	0	0	0	0	8	0	0	0	0	7	0	0	0	3	19	2
TOTAL OF CILIATES	67	0	26	0	0	6	8	54	49	4	2	7	15	78	95	101	62	16	15	21	96	14	14	107	162	92	0	65	25	96	186	48
Tintinidos:																																
Amphorella	0	36	0	0	44	0	72	0	0	52	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

S=Surface **M=Medium** **B=Bottom**

Station	T1-6	T1-10		T1-17			T3-6	T3-10	T3-12		T3-17			T5-6	T5-10	T5-12		T5-17			T6-6	T6-10		T6-16			T8-6	T8-10		T8-16		
Level	**S**	**S**	**B**	**S**	**M**	**B**	**S**	**S**	**S**	**B**	**S**	**M**	**B**	**B**	**S**	**S**	**B**	**S**	**M**	**B**	**S**	**S**	**B**	**S**	**M**	**B**	**S**	**S**	**B**	**S**	**M**	**B**
amphora																																
Codonellopsis pusilla	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Eutintinnus tubulosus	0	24	0	0	0	0	152	0	0	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Favella ehrenbergii	0	4	0	0	0	0	40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Helicostomella subulata	0	0	0	0	0	0	16	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tintinopsis levigata	0	0	9	0	0	0	0	0	0	0	0	0	0	19	123	73	24	0	0	0	12	0	0	7	14	37	0	0	0	25	41	3
Tintinopsis nana	0	4	0	0	0	0	12	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tintinopsis sp	48	0	3	0	44	0	0	31	23	0	0	0	4	31	125	105	23	2	0	3	15	31	2	4	5	6	0	1	1	9	10	27
Xystonella treforti	0	0	0	0	0	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
TOTAL OF TINTINIDOS	48	68	12	4	88	11	292	31	23	80	0	0	4	50	248	178	47	2	0	3	27	31	2	12	19	43	0	1	1	34	51	30
Zooplankton																																
Apendicularia	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	2	1	0	0	0	0	0	0	0	1	5	0	0	0	0	0	0
Cladocero	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Copepodo	0	0	1	0	0	1	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	1	0	2	6	0	0	0	0	0	0
Larva de bivalvo	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	1	0	0	1	2	0	0	0	0	1	1
Larva de poliqueto	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0
Nauplio	0	0	0	0	0	2	0	0	0	0	0	0	0	0	1	0	0	0	2	7	2	1	2	3	2	8	0	1	2	0	5	6
TOTAL OF ZOOPLANKTON	0	0	2	0	0	3	0	0	1	0	0	1	0	1	2	2	5	0	2	7	3	2	3	3	6	23	0	1	2	0	6	7

Table 3-23. Composition and abundance of zooplankton (individuals/sample) obtained at surface level, Spring 2002. Pampa Melchorita

Station		T1-6	T1-17	T3-10	T3-12	T3-17	T4-17	T5-10	T5-12	T5-17	T7-10
Group/Order/Family	**Genus/Specie**										
CIRRIPEDIA	Not determined	0	0	0	1	0	0	0	0	0	0
CLADOCERA	*Pleopis* sp	64	0	32	32	0	192	48	48	256	256
COPEPODA	*Acartia tonsa*	83456	156160	20288	5920	158208	94592	22000	88896	223744	8421376
	Centropages brachiatus	384	49664	320	160	34432	576	0	768	11520	0
	Corycaeus dubius	0	0	0	0	128	48	0	0	128	0
	Oithona sp	512	0	0	0	0	0	0	0	0	0
	Paracalanus parvus	8448	126976	2816	1280	40576	1680	464	41344	83712	393216
	Scolecitrix sp	2	0	32	4	0	0	0	0	0	0
AMPHIPODA											
CAPRELLIDAE	Not determined	0	0	0	0	1	1	0	0	0	0
	Gammaridea	0	4	0	2	0	0	1	0	0	0
EUPHAUSIDA	Not determined	8833	108552	1600	1256	61964	256	192	7744	27136	2097152
DECAPODA	*Emerita analoga*	0	0	8	0	0	0	16	0	0	0
Galatheidae	Not determined	0	0	0	0	64	0	0	0	0	0
Grapsidae	Not determined	0	0	0	0	0	0	1	2	0	0
Total of species		7	5	7	8	7	7	7	6	6	4
Total of individuals		101699	441356	25096	8655	295373	97345	22722	138802	346496	10912000
Richness of species		0.5204	0.3077	0.5923	0.7721	0.4763	0.5224	0.5981	0.4223	0.392	0.1851
Pielou evenness		0.3257	0.8183	0.3433	0.4441	0.6118	0.08226	0.0874	0.4682	0.582	0.4594
Diversity (bits/ind)		0.9142	1.9	0.9638	1.332	1.717	0.2309	0.2454	1.21	1.365	0.9189

Table 3-24. Composition and abundance of icthyoplankton (individuals/sample). Spring 2002. Pampa Melchorita*

Station			T1-6	T1-17	T3-10	T3-12	T3-17	T4-17	T5-10	T5-12	T5-17	T7-10
Family	**Specie**	**Phase**										
Atherinidae	Odonthestes regia	larvae	0	0	0	0	0	24	1	0	0	0
Blennidae	Not determined	larvae	0	0	0	0	0	0	1	1	0	0
Engraulidae												
	Engraulis ringens	eggs	1536	88832	2024	5336	15072	5816	256	16224	51456	34816
	Not determined	eggs	0	0	120	100	160	32	16	32	256	2048
Not determined		eggs	1152	512	2360	1808	5	176	616	1232	1280	34816

*Diversity analysis was not performed due to the scarce number of species

Table 3-25. Composition and abundance of macrobenthos species of the sub-tidal zone, Spring 2002. Playa Melchorita

Transect	T1			T2				T3				T4					T5				T6		T7	T8	
Station	**6 m**	**10 m**	**17 m**	**6 m**	**10 m**	**16 m**	**17 m**	**6 m**	**10 m**	**12 m**	**16 m**	**6 m**	**10 m**	**12 m**	**16 m**	**17 m**	**6 m**	**10 m**	**12 m**	**17 m**	**6m**	**16 m**	**10 m**	**6 m**	**16m**
ACTINIARIA	0	0	1	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ECHINODERMATA																									
Ophiuroideo	29	20	0	4	6	0	0	3	8	0	1	3	3	0	0	0	10	2	1	0	6	0	3	3	2
Holothuroideo	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PLATYHELMINTES																									
TURBELLARIA	53	0	0	16	2	0	0	44	0	0	0	0	5	0	0	0	2	0	3	0	18	0	4	0	0
NEMATODA	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	2	0	0	0
ANELLIDA																									
POLICHAETA																									
Owenia	0	5	9	6	2	5	22	0	0	1	40	0	1	13	33	10	0	0	0	14	0	111	0	1	22
OWENIDAE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
Magelona	0	0	58	0	17	2	65	5	0	0	0	0	0	3	1	1	0	13	0	2	0	8	0	0	3
SPIONIDAE	0	0	0	14	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	35	2	0	0	0
ONUPHIDAE																									
Diopatra rhizoicola	0	0	0	6	3	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	1	1	0	2
DORVILLEIDAE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0
FLABELLIGERIDAE																									
Pherusa sp	1	0	0	1	1	0	0	0	0	0	0	0	2	1	0	0	0	0	14	0	2	0	1	0	1
SILLIDAE																									
Syllis sp	0	0	0	12	0	0	0	0	10	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0
COSSURIDAE																									
Cossura sp.	0	0	0	8	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	0	1	0	2
NEREIDAE																									
Nereis sp	30	0	0	5	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Nephtys ferruginea	0	0	17	2	60	13	16	2	9	0	28	9	4	9	31	19	1	0	1	5	50	12	1	2	15
Parandalia fauvelli	0	0	0	0	0	1	4	0	0	0	6	0	0	0	0	1	0	0	0	0	1	0	0	0	16
CTENODRILIDAE	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Transecto	T1			T2				T3				T4					T5				T6		T7	T8	
Station	**6 m**	**10 m**	**17 m**	**6 m**	**10 m**	**16 m**	**17 m**	**6 m**	**10 m**	**12 m**	**16 m**	**6 m**	**10 m**	**12 m**	**16 m**	**17 m**	**6 m**	**10 m**	**12 m**	**17 m**	**6m**	**16 m**	**10 m**	**6 m**	**16m**
MOLLUSCA																									
Nassarius gayi	0	2	0	0	0	0	0	0	0	1	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0
Natica undata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2
Xanthochorus buxea	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Sinum cymba	1	1	1	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Donax marincovinchi	0	0	0	0	0	0	0	0	0	0	0	14	0	0	0	0	0	0	0	0	0	0	0	0	2
Semmimitylus algosus	1462	4	0	1	1	0	0	0	1	3	0	0	3	0	0	0	1	0	2	0	0	0	0	1	0
Mulina edulis	6	286	71	385	125	227	52	508	790	611	302	1	104	104	71	41	0	475	375	35	0	217	97	83	186
ARTHROPODA																									
CRUSTACEA																									
Calanus sp	0	0	0	0	5	81	30	5	0	0	0	0	0	0	0	0	0	0	0	0	7	0	0	31	0
Ampelisca sp.	0	0	0	0	12	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	2	0	2	2	1
Isocheles pacificus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0	0	0	2
Gammaridae	0	0	5	0	23	0	0	9	0	0	1	1	1	1	0	0	22	0	0	0	49	0	410	0	0
Cumacea	1	4	0	1	4	0	0	2	0	0	0	17	1	0	0	0	42	0	0	0	59	0	3	2	11
Undetermined Isopode	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0
Sphaeroma	0	0	0	6	2	0	0	0	0	0	0	3	1	0	0	0	16	0	0	0	10	1	0	0	0
Grapsus sp (zoeas)	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0
Pignogonido	0	0	0	5	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	6	0
Eufausido	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PHORONIDA	0	0	4	0	0	0	1	0	0	0	4	0	0	1	0	1	0	0	0	0	0	0	0	0	0
Density (indv/m^2)	1583	320	167	469	271	331	193	579	818	616	384	48	125	132	139	76	98	490	396	56	259	354	531	132	271
Total of species	8	7	9	15	19	8	10	9	5	4	9	7	11	7	6	9	8	3	7	4	15	8	14	10	15
Total of individuals	1583	322	167	472	272	331	193	579	818	616	385	48	126	132	139	76	98	490	397	56	259	354	531	132	271
Richness of species	0.950	1.039	1.563	2.274	3.211	1.206	1.710	1.258	0.596	0.467	1.344	1.550	2.068	1.229	1.013	1.847	1.527	0.323	1.003	0.745	2.519	1.193	2.072	1.843	2.499
Pielou evenness	0.178	0.254	0.641	0.337	0.608	0.422	0.718	0.243	0.118	0.036	0.365	0.796	0.347	0.409	0.643	0.586	0.736	0.136	0.144	0.703	0.785	0.460	0.286	0.5037	0.4765
Diversity (bits/indv)	0.535	0.712	2.030	1.318	2.582	1.265	2.384	0.772	0.275	0.073	1.158	2.234	1.200	1.149	1.661	1.859	2.209	0.215	0.405	1.407	3.065	1.379	1.091	1.673	1.861

Table 3-26. List of birds and mammals found during the Autumn survey at Playa Melchorita.

BIRDS					
Family	**Species**	**Common Name**	**1º Trip**	**2º Trip**	***TOTAL***
SULIDAE	*Sula variegata*	"piquero común"	178	903	1081
PELECANIDAE	*Pelecanus thagus*	"Peruvian pelican"	29	129	158
CATHARTIDAE	*Coragyps atratus*	"black-head turkey buzzard"	2	1	3
CATHARTIDAE	*Cathartes aura*	"red-head turkey buzzard"	1	22	23
HAEMATOPODIDAE	*Haematopus ostralegus*	"Oystercatcher"	1	3	4
LARIDAE	*Sterna sp.*	"Gaviotín"	161	5	166
LARIDAE	*Larus modestus*	"Gray seagull"	727	196	923
LARIDAE	*Larus belcheri*	"Peruvian seagull"	2	4	6
LARIDAE	*Larus dominicanus*	"Dominican seagull"	0	1	1
MAMMALS					
Family	**Specie**	**Common name**	**1º Trip**	**2º Trip**	***TOTAL***
OTARIIDAE	*Otaria byronia*	"Common wolf"	1	0	1
DELPHINIDAE	*Tursiops truncatus*	"bottle-nose dolphin"	4	7	11

Table 3-27. List of birds and mammals found during the Spring survey at Playa Melchorita.

BIRDS					
Family	**Species**	**Common Name**	**1º Trip**	**2º Trip**	**Total**
SULIDAE	*Sula variegata*	"piquero común"	49	0	25
PHALACROCORACIDAE	*Phalacrocorax olivaceus*	Cushuri	1	0	1
PELECANIDAE	*Pelecanus thagus*	"Peruvian pelican"	284	190	237
CATHARTIDAE	*Coragyps atratus*	"black-head turkey buzzard"	9	25	17
CATHARTIDAE	*Cathartes aura*	"red-head turkey buzzard"	11	2	7
HAEMATOPODIDAE	*Haematopus ostralegus*	"Oystercatcher"	10	9	10
LARIDAE	*Sterna sp.*	"Gaviotín"	1	1	1
LARIDAE	*Larus modestus*	"Gray seagull"	5008	7093	6051
LARIDAE	*Larus belcheri*	"Peruvian seagull"	20	4	12
LARIDAE	*Larus dominicanus*	"Dominican seagull"	2	13	8
SCOLOPACIDAE	*Numenius phaeopus*	Zarapito	7	6	7
MAMMALS					
Family	**Species**	**Common Name**	**1º Trip**	**2º Trip**	**Total**
OTARIIDAE	*Otaria byronia*	"Common wolf"	0	0	0
DELPHINIDAE	*Tursiops truncatus*	"bottle-nose dolphin"	0	0	0

4 common wolf and 4 dolphins found dead on shore.