Interactive comment on "Distributions and assemblages of larval fish in the East China Sea in the northeasterly and southwesterly monsoon seasons 2008" by Chen et al.

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Response to E. Daly

Thanks for the very constructive comments. We have made presentation following reviewer's suggestions and revised the figures. Below, we copied reviewer's comments in bold, followed by our responses. Corrected figures are shown in the end of this document.

Critical to this study is the zooplankton data and with no mention of zooplankton collections or methodology I am left to interpret the data as it is written: Zooplankton Wt (g). which may mean that there was no standardization for volume towed of the zooplankton data. This needs to be corrected and figure 6 and figure 7 reanalyzed.

[Response] corrected.

P7078 line 13:

Larval fish and zooplankton abundance were calculated and standardized as CPUE (number of individuals/1000m3) and zooplankton Wt (g/1000 m^3).

P.7080 line 19:

Figure 6 shows the relationships between CPUEs and the environmental variables: sea surface temperature, primary production and zooplankton wet weight. In the northeasterly monsoon season, CPUE were significantly, positively correlated ($r = 0.61$, $p < 0.05$) with sea surface temperature only. There was no significantly correlation between CPUE and zooplankton Wt, when station E20 where a shrimp bloom occurred was excluded ($r = -0.06$, $p > 0.05$) (Fig. 6c). In the southwesterly monsoon season, a significant, positive correlation was found only between CPUE and primary production ($r = 0.64$, $p < 0.05$). A positive correlation was also found between CPUE and zooplankton Wt, when Station E19A where Changjiang River discharges occurred was excluded ($r = 0.82$, $p < 0.05$) (Fig. 6f).

P.7081 line 6:

The ordination diagrams of canonical correlation analysis (CCA) of CPUEs of dominant larval fish taxa and environment variables are shown in Fig. 7. In the northeasterly monsoon period, CPUE of each of *Sigmops gracilis* was positively related with sea surface temperature and sea surface salinity, but negatively with nutrients, DO and zooplankton Wt and opposite to CPUE of scorpaenid larvae (Fig. 7a). In the southwesterly monsoon season, the CPUE of *Engraulis japonicus* was positively related with primary production. *Saurida* spp. and gobiid type1 larvae were negatively with sea surface salinity and opposite to CPUE of gobiid type 2 (Fig. 7b).

The authors state in the abstract that the food availability are affecting the larval abundance in the southwesterly monsoon season: not according to Fig 6 which shows a possible but weak relationship to zooplankton and the winter monsoon season, not summer, but looking at the ordination diagram in figure 7b it does look like only the summer coastal community is affected by both zooplankton wet weight and primary production. This would be interesting to explore once the zooplankton data is standardized between stations.

[Response] We revised the zooplankton Wt (g) into standardization zooplankton Wt (g/1000m^3). The paragraph has been revised as following and the figure 6 was corrected. In this study the situations of winter and summer were different. In winter, a significant, positive correlation was found only between CPUE and sea surface temperature. In summer, CPUE were significantly, positively correlated with primary production and zooplankton wet weights. We revised the result paragraph of 3.2. P.7080 line 19 (the result of 3.2):

Figure 6 shows the relationships between CPUEs and the environmental variables: sea surface temperature, primary production and zooplankton wet weight. In the northeasterly monsoon season, CPUE were significantly, positively correlated ($r = 0.61$, $p < 0.05$) with sea surface temperature only. There was no significantly correlation between CPUE and zooplankton Wt, when station E20 where a shrimp bloom occurred was excluded ($r = -0.06$, $p > 0.05$) (Fig. 6c). In the southwesterly monsoon season, a significant, positive correlation was found only between CPUE and primary production ($r = 0.64$, $p < 0.05$). A positive correlation was also found between CPUE and zooplankton Wt, when Station E19A where Changjiang River discharges occurred was excluded ($r = 0.82$, $p < 0.05$) (Fig. 6f).

Figure 8 would be improved by adding circles encompassing the assemblages and possibly adding labels to the assemblages. The inshore assemblage in winter extends the entire sampling region coinciding with the China coastal current and there is also a minor offshore assemblage in winter. For the summer monsoon

season, there is a summer coastal assemblage in a strip along the coast that has a higher abundance of larvae than any other assemblage. There is also a larger offshore community than in winter and a much spatially reduced inshore community pressed into the NE area of the sampling grid. I would recommend that figure 8 proceed the CCA, and that the CCA include as a factor the assemblages identified in the dendograms for both monsoon seasons to help understand what environmental variable are affecting the various community in each monsoon season. Additionally, I believe the Mann-Whitney u-test should be based on monsoon/assemblage differences and should come after the community analysis.

[Response] We modified the figure 8 and added CCA analysis including assemblage factor.

Added a paragraph of 3.3:

Figure 9 showed the ordination diagrams of canonical correlation analysis (CCA) to evaluate the relationship between assemblages and environment variables. Inshore assemblage in the southwesterly monsoon season was positively related with sea surface temperature but negatively with DO and opposite to inshore assemblage of the northeasterly monsoon season (Fig. 9). Summer coastal assemblage showed a negative relationship with sea surface salinity and positive relationship with nutrient and primary production. Offshore assemblage in the northeasterly monsoon season was negatively related with zooplankton wet weight.

Added a paragraph of 4.3:

Hsieh et al. (2011) proposed the China Coastal Current group come from the coastal waters of mainland China when the northeasterly monsoon reigned and Kuroshio group was from the offshore Kuroshio waters year-round. This phenomenon could also explain the relationship between inshore assemblage and sea temperature (Fig. 9).

Gong et al. (2011) also reported Changjiang River floods enhanced coastal ocean phytoplankton biomass potentially enhancing fish production. Therefore summer coastal assemblage was well received by influent of Changjiang River flood and negatively relation with sea surface salinity (Fig. 9).

Lastly, as there was no difference between CPUE in the day/night samples that this is dropped and possible added to the methods. . . we tested for night/day differences for each monsoon season and did not find significant differences and as such we combined all samples together. . .

[Response] corrected as suggested.

Specific comments:

Last paragraph of the introductions: the hypothesis of this study needs to be more clearly stated.

The changes of monsoon phenomenon are the most influence variations environment of the East China Sea. For this reason, this survey focuses on changes of different monsoons. We tried to investigate the species composition, spatial distributions of fish larval assemblages and abundance of larval fish in the ECS. In addition, we compared larval fish between the two distinct monsoon seasons and their relationships to environment factors on the continental shelf of East China Sea. Moreover, we discussed and determined the effect larval abundance factors.

Materials and methods: line 10, "were picked up" should be changed to "sorted. . . from the collections. . .

[Response] corrected.

Zooplankton methods need to be added Data analysis: Line 26 -Adding a statement prior to Cluster analysis. . . such as: To examine community structure of the larvae for each monsoon season, we used cluster analysis. . .

[Response] corrected.

4.2 of Discussion: last paragraph just before 4.3 this statement contradicts statements made in abstract

[Response] corrected.

We rewrite the discussion paragraph of 4.2.

P.7083 line 18 (paragraph of 4.2):

The major factors of larval abundance were temperature and food sources. First, we discussed sea temperature influence on abundance of larvae. In this study the abundance of larval fish in the northeasterly monsoon season was found to be much lower than that in the southwesterly monsoon season in the ECS (Table 2), a fairly similar result obtained by Hernandez et al. (2010). It has been known that larval fish are significantly abundant in the warm season (Meekan et al., 2003) and the low temperature (< 20 ºC) in general is not suitable for larval fish to live. Batty and Blaxter (1992) and Stoll and Beeck (2012) also indicate that growth and swimming ability of larval fish was impeded by the low temperature. Okazaki and Nakata (2007) suggest that the abundance of larval fish and species number are less so at lower temperature and increased with the warm temperature.

However, CPUE in our result were significantly positively correlated with sea surface temperature in the winter but not in summer. One reason was that in winter the sea temperature was variable and cold, so fish larvae increased with the increases of sea temperature. Another reason was that in summer the sea temperature was stable and warm (ca. 22~30 ºC), so temperature was not a limiting factor for larval survive any longer. The suitable warm temperature is considered to an important factor affecting the survival and production of larval fish in the northeasterly monsoon season (Zenitani et al., 2009). Based on the above, it is interesting that the larval increased with primary production and zooplankton but not SST in the southwesterly monsoon season contrast with the northeasterly monsoon season (Fig. 6). This suggested that the influence of SST on survival and production of larval fish decreased as the environment became warmer (> 25 ºC).

Food sources were another key for larval survive after the burn off all nutrient of yolk sac. In previous studies authors used zooplankton abundance and primary production measurements as indicators of the amount of fish larval food sources (e.g., Hsieh et al., 2010; Chen et al., 2012). Hsieh et al. (2010) was found abundance of larval fish was positively related to zooplankton wet weight and presumed to relate to availability of food sources. CPUE in our result were significantly positively correlated with zooplankton and primary production in the summer but not in winter. However, development stages of the larval fish collected with the ORI net with a mesh size of 330 um mesh was dominated by the pre-flexion and flexion stages. The mouth development at these stages was not completely established to enable the larvae to capture most of mature zooplankton.

Therefore, even zooplankton was also known to be the primary prey for larval fish. Mouth widths of larval fish must match with the prey sizes in predation (Cunha and Planas, 1999). Fifty percent of the larvae are able to capture prey when the size of the prey was equal to 85% of the width of the mouth. When the prey size is less than 57% of the width of the mouth, more than 95% larvae were able to capture them (Hunter and Kimbrell, 1980). In addition, Chen et al., (2012) was found that sea surface temperature was significantly positively correlated with zooplankton wet weight. Therefore, it was difficult for this study to examine whether zooplankton wet weight was a causal factor for the fish larval abundance, even they were significantly, positively correlated in the southeastern monsoon season (Fig. 6). The primary production is the biomass index of food availability for fish (Chen et al., 2004), suggesting that the production and survival of larval fish were influenced by primary production availability in the southwesterly monsoon season.

4.3 of discussion: was there a test on the difference between the species composition of the three assemblages? the authors state that there was a significance difference, yet I am not sure what this is based upon. Last paragraph of 4.3: "The summer coastal assemblage was biggest among the three assemblages" this infers that largest spatially, but I believe you mean highest CPUE. This point should be tested by the Mann-Whitney test by including assemblage.

[Response] We add a table (Table 4) about test for CPUE difference among the three assemblages.

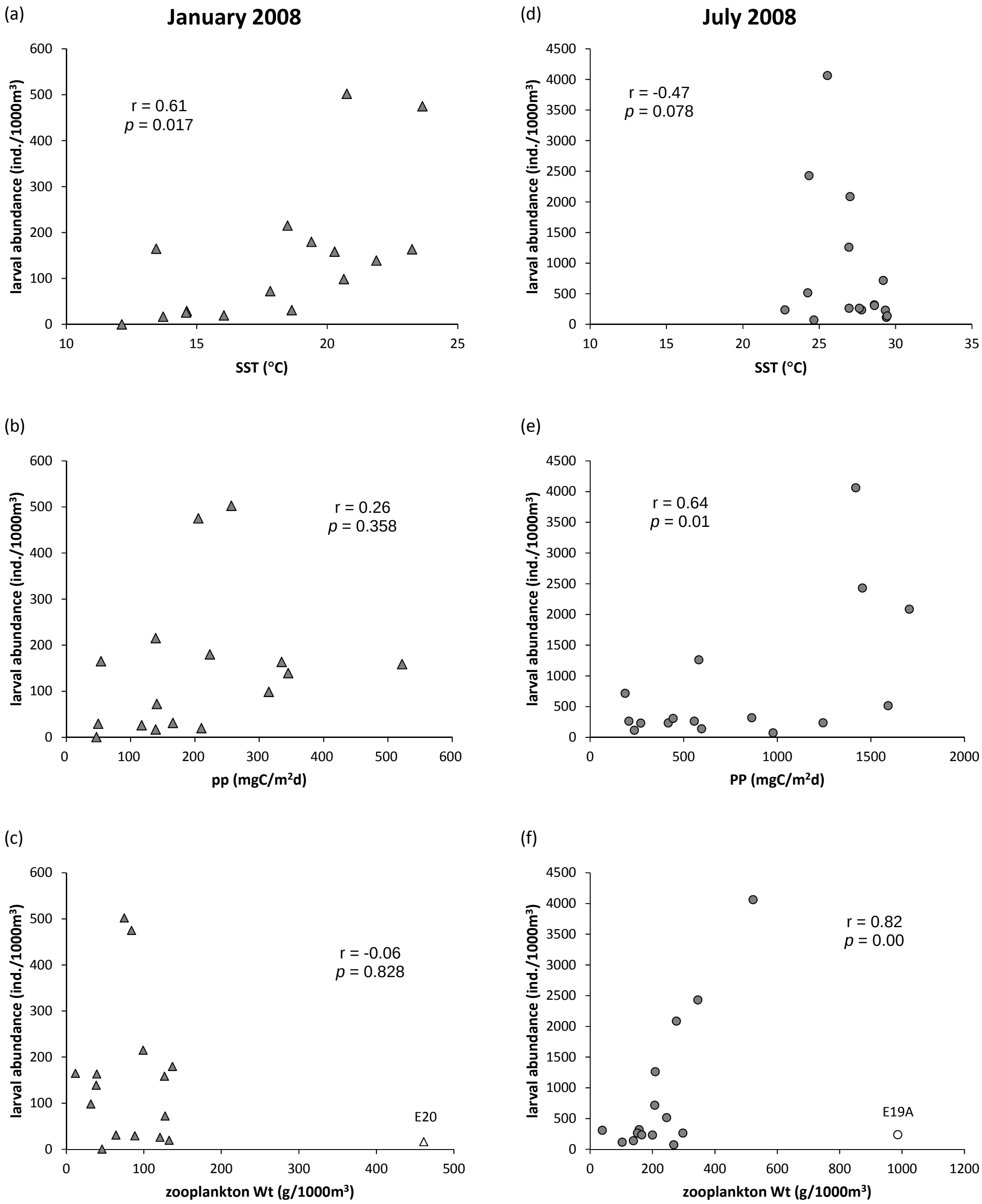
P.7078 line 24:
Mann–Whitney U-test was used to determine the significant level in difference of CPUEs between the two monsoon seasons. Kruskal-Wallis test was comparisons among CPUEs of three assemblages. For post hoc comparisons, Dunn's test was applied. Chi-square analysis was a test on the difference between the species composition of the three assemblages.

P.7081 line 23:
Species composition of the three assemblages were difference (chi-square test, $p<0.05$).

Table 4. Result of Kruskal-Wallis test and Dunn's test (post hoc comparisons) among CPUEs of three assemblages.

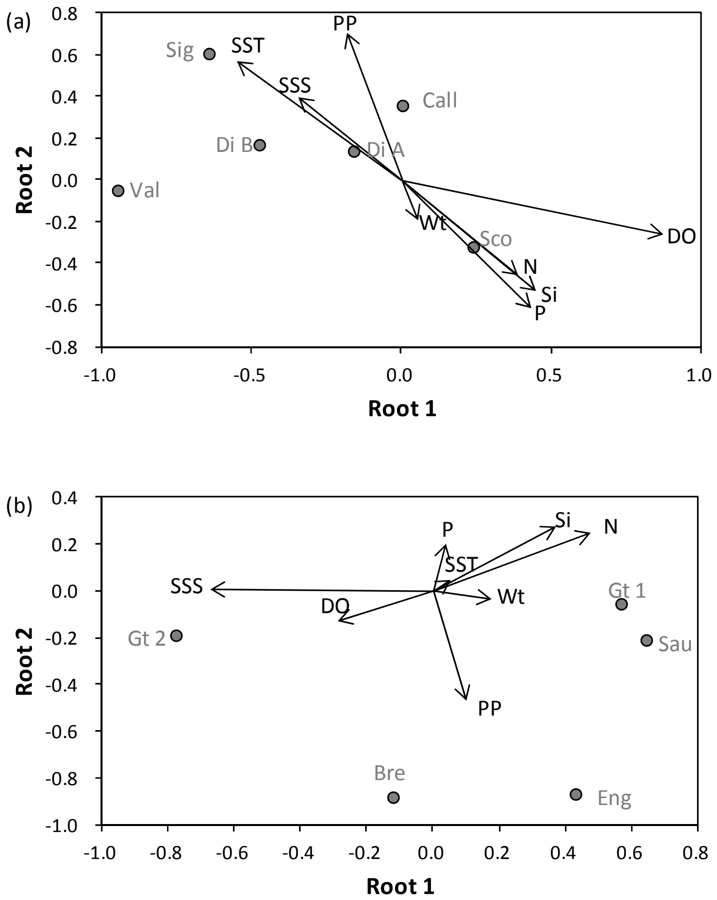
Inshore assemblage Median (IQR)	**Offshore assemblage Median (IQR)**	**Summer coastal assemblage Median (IQR)**	*p*
72[a] (153)	235[a] (161)	2085[a] (1169)	<0.01*

IQR, InterQuartile range.
a, Inshore assemblage was a difference from offshore and summer coastal assemblage.



(a)
January 2008
r = 0.61
p = 0.017
larval abundance (ind./1000m³)
SST (°C)
(b)
r = 0.26
p = 0.358
larval abundance (ind./1000m³)
pp (mgC/m²d)
(c)
r = -0.06
p = 0.828
E20
larval abundance (ind./1000m³)
zooplankton Wt (g/1000m³)
(d)
July 2008
r = -0.47
p = 0.078
larval abundance (ind./1000m³)
SST (°C)
(e)
r = 0.64
p = 0.01
larval abundance (ind./1000m³)
PP (mgC/m²d)
(f)
r = 0.82
p = 0.00
E19A
larval abundance (ind./1000m³)
zooplankton Wt (g/1000m³)

Fig. 6.



SST: sea surface Temp.
SSS: sea surface Sal.
DO: bottom DO
N: surface NO_3
P: surface PO_4
Si: surface SiO_3
PP: primary production
Wt: zooplankton wet weight
Bre: *Bregmaceros* spp.
Call: Callionymid larvae
Di A: *Diaphus* A
Di B: *Diaphus* B
Eng: *Engraulis japonicus*
Gt1: Gobiid type 1
Gt2: Gobiid type 2
Sau: *Saurida* spp.
Sco: Scorpaenid larvae
Sig: *Sigmops gracilis*
Val: *Valamugil* sp.

Fig. 7.

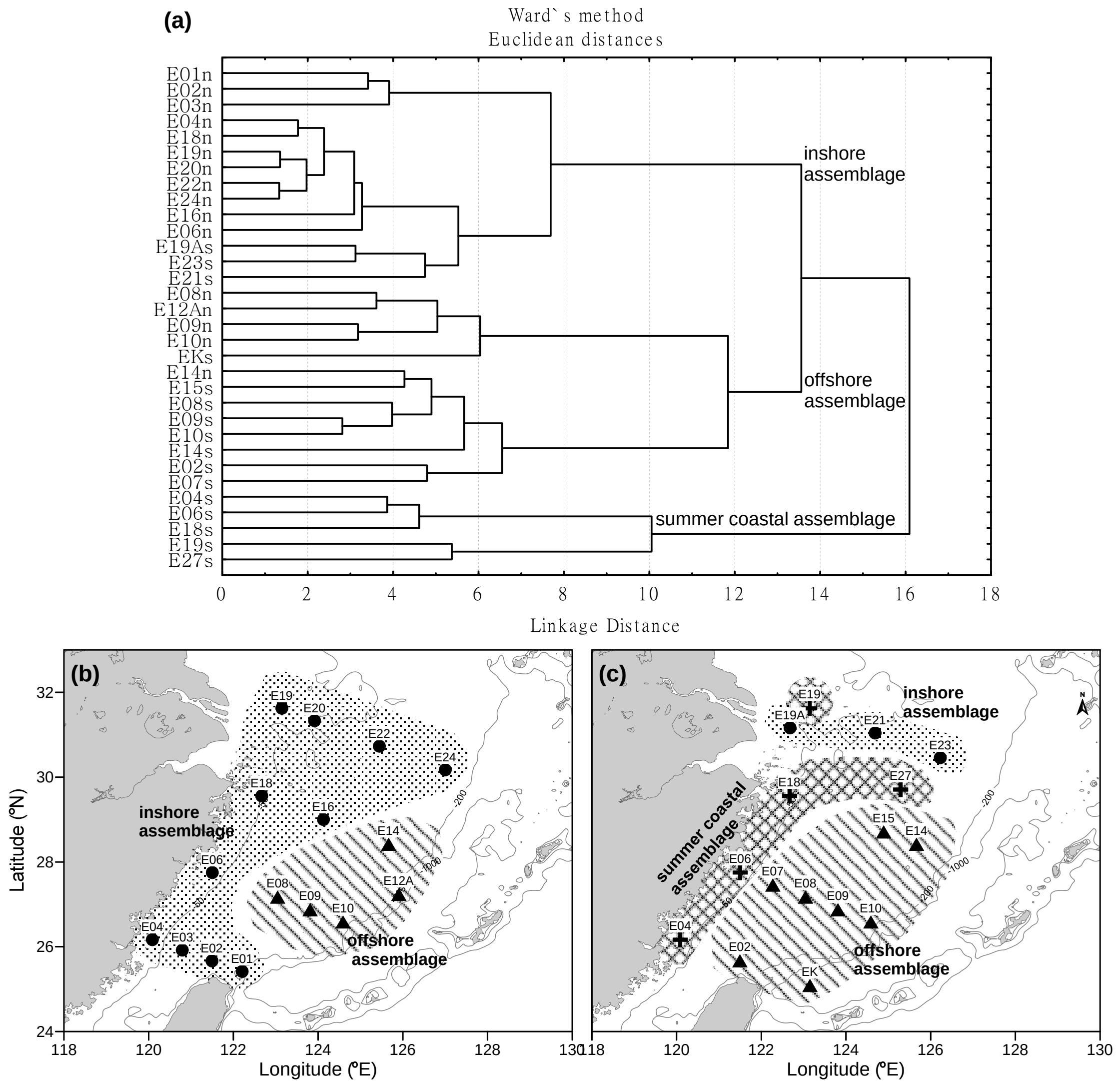
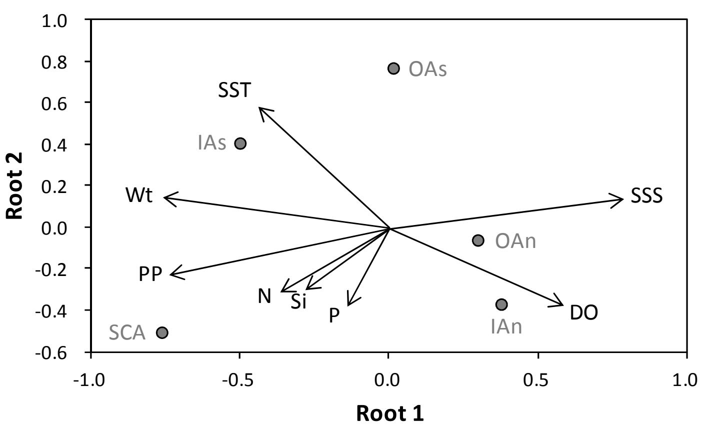

(a)
Ward`s method
Euclidean distances
E01n
E02n
E03n
E04n
E18n
E19n
E20n
E22n
E24n
E16n
E06n
E19As
E23s
E21s
E08n
E12An
E09n
E10n
EKs
E14n
E15s
E08s
E09s
E10s
E14s
E02s
E07s
E04s
E06s
E18s
E19s
E27s
inshore assemblage
offshore assemblage
summer coastal assemblage
0 2 4 6 8 10 12 14 16 18
Linkage Distance
(b)
(c)
Latitude (°N)
Longitude (°E)
inshore assemblage
offshore assemblage
summer coastal assemblage
E19
E20
E22
E24
E18
E16
E06
E14
E08
E09
E10
E12A
E04
E03
E02
E01
E19A
E21
E23
E27
E15
E07
EK
-200
-1000

Fig. 8.



SST: sea surface Temp.
SSS: sea surface Sal.
DO: bottom DO
N: surface NO_3
P: surface PO_4
Si: surface SiO_3
PP: primary production
Wt: zooplankton wet weight
IAn: Inshore assemblage (NE)
IAs: Inshore assemblage (SW)
OAn: Offshore assemblage (NE)
OAs: Offshore assemblage (SW)
SCA: Summer coastal assemblage

Figure 9. Ordination diagram of canonical correlation analysis (CCA) showing the relationships between hydrographic factors and abundance of assemblages.