

Interactive comment on “Long term changes in the ecosystem in the northern South China Sea during 1976–2004” by X. Ning et al.

X. Ning et al.

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At first authors of the present paper appreciate the Referee #2 for spending time to give detailed and very significant comments, and providing some significant opinions. Our answers on the comments are as follows: General comments: Referee #2; can't perfectly convince two issues: One is in section 4.4, Response of ecological environment to ENSO event;. Authors show the comparison of fluctuations in environment parameter (T, S, DO, PO₄, SiO₃, DIN) to ENSO event at Station 4 on Figure 1. The data set for this discussion was only one snapshot in summer at station 4 in each year, and may be timing of the sampling was different among seasonal variability in every year. It is difficult to convince that the fluctuations significant related to ENSO, without any statistic analysis. Is the data from station 4 suitable for extract the only signal

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from open sea? In my understanding from the discussion part in this manuscript, section 4.1-4.3, station 4 data include a signal from river water discharge and coastal change. If authors can provide more clear explanation on this aspect, it would be better to understanding for readers that ecological environment response to ENSO event; Second is in section 4.5, Response of the ecosystem and living resources;. As authors indicated in their discussion, one possible reason for the increase in both the cephalopod and demersal trawl catches (also in Fig. 10) could be attributed to the improvement of demersal trawl fishing techniques. It is difficult for evaluate only the effect of the increase in stock of lower trophic level. I think it is not easy to compare the long term trend of environment parameter to cephalopod and demersal trawl catches data;. These two issues on Referee #2; can;t perfectly convincible can be interpreted as follows: 1. In P3752;Line 4 the opposite occurs. should be changed to the opposite occurs. This is due to ENSO events affect the strength of the summer monsoon related. During El Nino phenomena happen, the heat convection over the warm pool of the western Pacific move to central Pacific; and that during the La Nina event occur, the heat convection over the warm pool of the western Pacific set the western Pacific, and that it make the anomaly of Walk circumfluence. Namely, when phase of El Nino (La Nina), and under the influence of the Walker circulation anomaly, subsidence (ascending) air current occur over low latitude and middle latitude of the east Asia; at this time is in summer that this subsidence (ascending) air current superposition to west-south monsoon, result in weaken (strengthen) of the summer monsoon (Wang et al.;2001, Zhang et al., 2003; Zhu et al., 2000). The changes of ecological environment in the sea area around Station 4 in summer respond to ENSO events, namely, respond to the abnormity of summer monsoon. 2. We adhere to the original opinion, because we think that the increase in both the cephalopod and demersal trawl catches could be partially attributed to the improvement of demersal trawl fishing techniques. It is useless of fishing gear if there is no or little fishery resources in the sea. Moreover,

we consider that demersal trawl catches could be partially attributed to the improvement of demersal trawl fishing techniques, and mainly to the increase in stock and production of low trophic levels, induced by the reduction in N limitation in the nSCS (P.3752, L.17-20). It was shown in Table 6 that chlorophyll a, primary production, phytoplankton abundance, benthos biomass, etc. pronouncedly increased, which were leading to increase in fisheries resources in the second phase. In contrast to those in the Bohai Sea, where although the fishing techniques have been improved, fish catch has been still decreasing continuously. For example, in Laizhou Bay, the most important fishing area of the Bohai Sea, the demersal trawl fish catch in 1998 was 11.9% of the catch in 1992-1993, 7.3% of it in 1982, and only 3.3% of it in 1959 (Jin, 2002a, 2002b, 2002c). This probably resulted from decrease in low trophic levels, such as phytoplankton abundance and biomass, primary production, zooplankton abundance and biomass, and their biodiversity (Tang & Jin, 2002; Fei, 1991; Meng, 2002). In addition, in the East China Sea, the CPUE (catch per unit effort) for the demersal trawl fish catch have been also decreasing continuously during 2000-2005 (Lin et al., 2007). Through the comparison, we believe that the increase in the demersal trawl fish catch in the nSCS is not only due to the increasing fishing efforts, but also improving fish resources. In P3752, line 17, 'The increase in both demersal trawl catches and demersal trawl catches could be attributed to demersal trawl catches partially could be attributed to demersal trawl catches'; should be changed to 'Besides, the increase in both demersal trawl catches and demersal trawl catches could be attributed to demersal trawl catches'; should be changed to 'demersal trawl catches partially could be attributed to demersal trawl catches';

The changes of Specific comments: 1. P3738, line 8-10, I think authors can remove explanation of R_{xt} , which was defined as the correlation coefficient between the time series of an environmental parameter and the nature number, from the abstract. Reply: delete the R_{xt} . 2. P3738, line 15, Nav:Pav; In the text, it is represented by N:Pav;. It is better to represent same symbol through the manuscript. I suppose Nav:Pav and SSN:SSP are better than N:Pav and SSN:P. Some of these are represented by SN:P. Reply: This

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idea is right, should be changed as following: In P3742, line 10, “SN:P, N:Pav, N:P200, SSi:N, Si:Nav, Si:N200” should be changed to “SSN:SSP, Nav:Pav, N200:P200, SSSi:SSN, Siav:Nav, Si200:N200”； in P3745, line 22, “(SSN:P) and 18.0 (N:Pav)” should be changed to “(SSN:SSP) and 18.0 (Nav:Pav)”; in P3745, line 24, “(SSSi:N) and 1.4 (Si:Nav)” should be changed to “(SSSi:SSN) and 1.4 (Siav:Nav)”; in P3747, line 12, “(SSN:P, N:Pav and N:P200)” should be changed to “(SSN:SSP, Nav:Pav and N200:P200)”; in P3747, line 14, “N:Pav and N:P200” should be changed to “Nav:Pav and N200:P200”; in P3747, line 16 and 17, “SSN:P” should be changed to “SSN:SSP”; in P3750, line 6, “SSN:P and N:Pav ” should be changed to “SSN:SSP and Nav:Pav”; in P3750, line 13, “SSN:P and N:Pav ” should be changed to “SSN:SSP and N av:Pav ”; in P3750, line 16, “SSSi:N (Si:Nav,)” should be changed to “SSSi:SSN (Siav:Nav,)”; in P3750, line 22, “SSN:P and N:Pav” should be changed to “SSN:SSP and Nav:Pav”; in P3750, line 23, “SSSi:N, Si:Nav and BSi:N” should be changed to “SSSi:SSN, Siav:Nav and BSi:BN ”; in P3750, line 24, “SSN:P and BN:P were higher than 22, and N:Pav” should be changed to “SSN:SSP and BN:BP were higher than 22, and Nav:Pav” in P3762, Table 1, “SSN:P, N:Pav , N:P200, SSSi:N ,Si:Nav, Si:N200” should be changed to “SSN:SSP, Nav:Pav, N200:P200, SSSi:SSN, Siav:Nav, Si200:N200”； in P3764, Table 3, “SSN:P, N:Pav , BN:P, SSSi:N, Si:Nav, BSi:N, SSi:P ,Si:Pav, BSi:P” should be changed to “SSN:SSP, Nav:Pav, BN:BP, SSSi:SSN, Siav:Nav, BSi:BN, SSSi:SSP, Siav:Pav, BSi:BP”; in P3776, Fig. 8 (changed to Fig. 9), “SSN:P, water column average N:P(N:Pav) and N:P at the 200m layer (N:P200),” should be changed to “SSN:SSP water column average N:P (Nav:Pav) and N:P at the 200m layer (N200:P200),” in P3777, Fig.9 (changed

to Fig. 10), Si:N (SSSi:N), water column average Si:N (Si:Nav) and Si:P at the 200m layer (Si:N200), should be changed to Si:N (SSSi:SSN), water column average Si:N (Siav:Nav) and Si:P at the 200m layer (Si200:N200);

3. P3739, line 2 - 3, what is the world's 50 Large Marine Ecosystems? I think it is not necessary in introduction. Reply: In P3739, line 2 - 3, constituting one of the world's 50 Large Marine Ecosystems (Sherman, 2001) should be deleted; in P3759, line 6 & 7, Sherman, K.: Large Marine Ecosystems. in: Encyclopedia of Ocean Sciences, edited by: Thorpe, J. H. and Turekian, S. A., Academic Press, London, 1462-1469, 2001. should be deleted.

4. P3739, Line 16, some unit is represent as $m^3 a^{-1}$. I understand that a is may be annual, but it is better to represent by y^{-1} as follows in the manuscript. Reply: In P3739, Line 16, $3.3 \times 10^{11} m^3 a^{-1}$ (Han et al., 1998). It carries a large quantity of suspended solids $8.3 \times 10^7 t a^{-1}$, Han et al., 1998) and dissolved nutrients ($N=8.6 \times 10^4 t a^{-1}$; $P=1.2 \times 10^4 t a^{-1}$; $Si=184.3 \times 10^4 t a^{-1}$), should be changed to $3.3 \times 10^{11} m^3 y^{-1}$ (Han et al., 1998). It carries a large quantity of suspended solids $8.3 \times 10^7 t y^{-1}$, Han et al., 1998) and dissolved nutrients ($N=8.6 \times 10^4 t y^{-1}$; $P=1.2 \times 10^4 t y^{-1}$; $Si=184.3 \times 10^4 t y^{-1}$).

5. In P3739, line 13-19, Authors introduce an information of river material discharge until 1996-1998 with refer the Han et al., 1998 and Wang and Peng, 1996. Is there any information for river material discharge after 1998? It would be very useful information. Reply: In P3739, line 18, 8.23×10^4 , Wang and Peng, 1996, should be changed to 8.23×10^4 , before 1998, Wang and Peng, 1996; and $N=19.14 \times 10^4 t y^{-1}$, $P=0.8 \times 10^4 t y^{-1}$ after 1998, SOAC, 2000-2004; in P3759, line 17, SOAC: Seawater Quality Results of Survey, SOAC, 2000-2004 (in Chinese) should be inserted;

6. P3741, in method, was the nutrients data collection started from 1989? The nutrients figures shows data from 1989. If so, author should describe collection period of the nutrient data set in to the method. Reply: In P3741, line 9, included

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ing NO₃-N, NO₂-N and NH₄-N]. Seawater; should be changed to including NO₃-N, NO₂-N and NH₄-N). The parameters of T, S and DO data collection started from 1976; the nutrients data (PO₄-P, SiO₃-Si, NO₃-N, NO₂-N and NH₄-N) collection started from 1989. Seawater; In P3773, Fig. 5, during 1976-2004; should be changed to during 1989-2004; In P3774, Fig. 6, during 1976-2004; should be changed to during 1989-2004; In P3777, Fig. 9, during 1976-2004; should be changed to during 1989-2004; In P3775, Fig. 7, in the nSCS; Should be changed to in the nSCS during 1989-2004; In P3776, Fig. 8 (changed to Fig. 9), during 1976-2004; should be changed to during 1989-2004; In P3777, Fig. 9 (changed to Fig. 10), during 1976-2004; should be changed to during 1989-2004; 7. In P3746, line 4-12, In the discussion on the increasing trend in temperature, authors discuss the increasing trend with air temperature and other area of the sea. Is there any change in water temperature which was discharged from Pearl River? May be the discharged water temperature affected more than air temperature in n-SCS area. Reply: There may be some impact, but the discharged water temperature is absence. 8. In P3746, line 14, please add a reference paper for consistent with the increase in DIN observed throughout the global marginal seas. Reply: It should be added. In P3759 line 4, Seitzinger, S. P., Kroeze, C., Bouwman, A. F., Caraco, N., Dentener, F. and Styles, R. V.: Global patterns of dissolved inorganic and particulate nitrogen inputs to coastal systems: recent conditions and future projections, *Estuaries*, 25(4), 640-655, 2002; should be inserted. 9. P3748, line 14, Is it possible to add figure of changes in the depth of 20°C isopleths? It would be useful for explain upwelling changing affect. Also it is helpful for readers understanding. Reply: In P3748, line 16, isopleths in the SCS. The high SSS; should be changed to isopleths in the SCS. In this study, the range depth of 20°C isopleths is 84-150m. The high SSS; 10. P3749, line 11, If authors add information on river

discharge flux of N, P, Si in both phases before and after 1998, it would be helpful information for readers. Reply: This information had been added in P3739. 11. P3752, line 10. Is this two phases; same phases as in N:P ratio discussion? Reply: In P3752, line 10. the two phases, the average; should be changed to the two phases (same phases as in N:P ratio discussion), the average;

Kind regards

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