



Regione Emilia-Romagna

Assessorato Ambiente e Sviluppo Sostenibile



ARPA
Agenzia Regionale Prevenzione e Ambiente
dell'Emilia-Romagna
Struttura Oceanografica Daphne



EUTROFIZZAZIONE DELLE ACQUE COSTIERE DELL'EMILIA-ROMAGNA

Rapporto 2004

Finito di stampare nel mese di settembre 2005
presso il Centro Stampa della Giunta Regionale



Figure

Tabelle

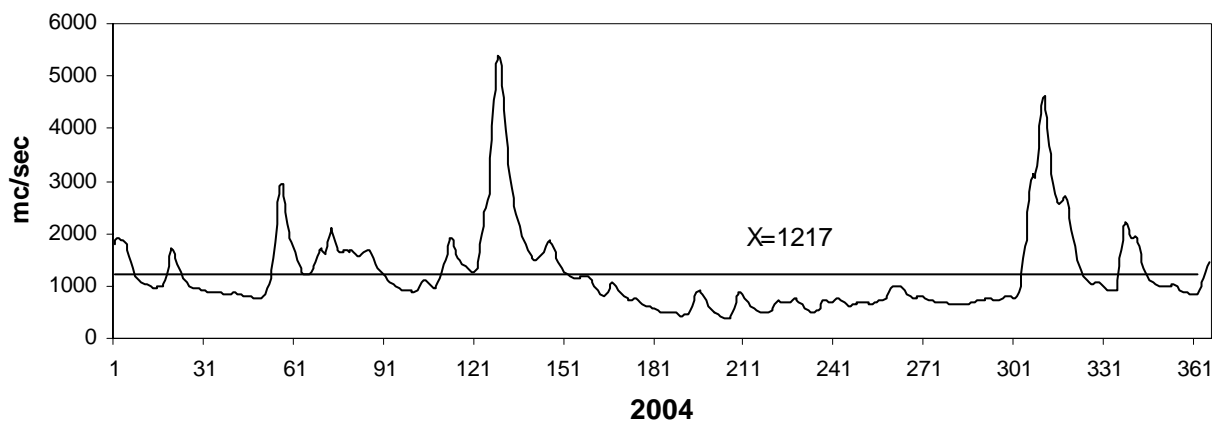


Fig 2 Portate fiume Po rilevate a Pontelagoscuro (FE)

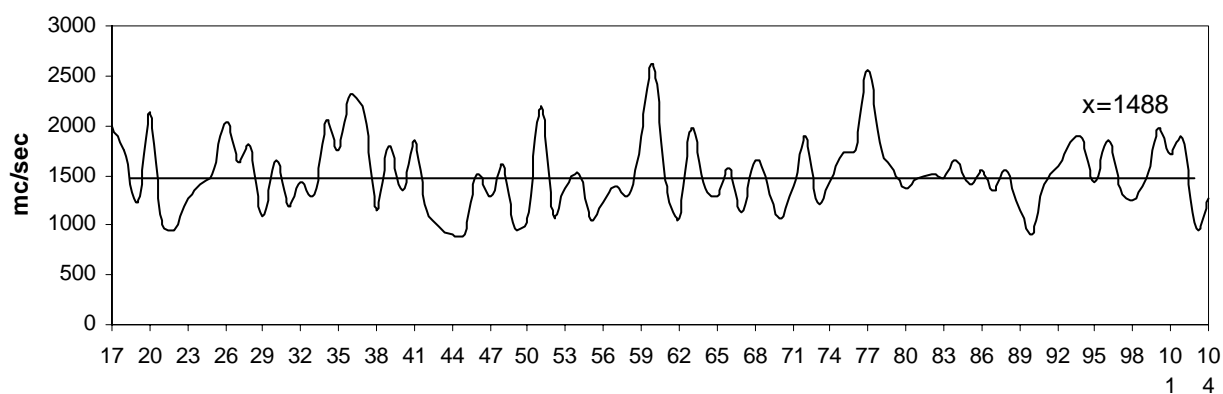


Fig 3 Valori medi annuali portate fiume Po. Periodo 1917-2004

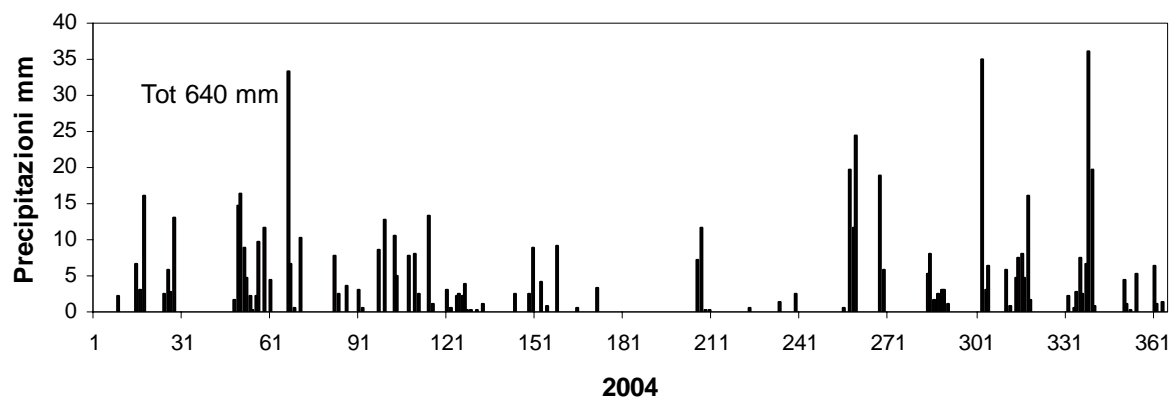


Fig 4 Precipitazioni atmosferiche rilevate a Cesenatico

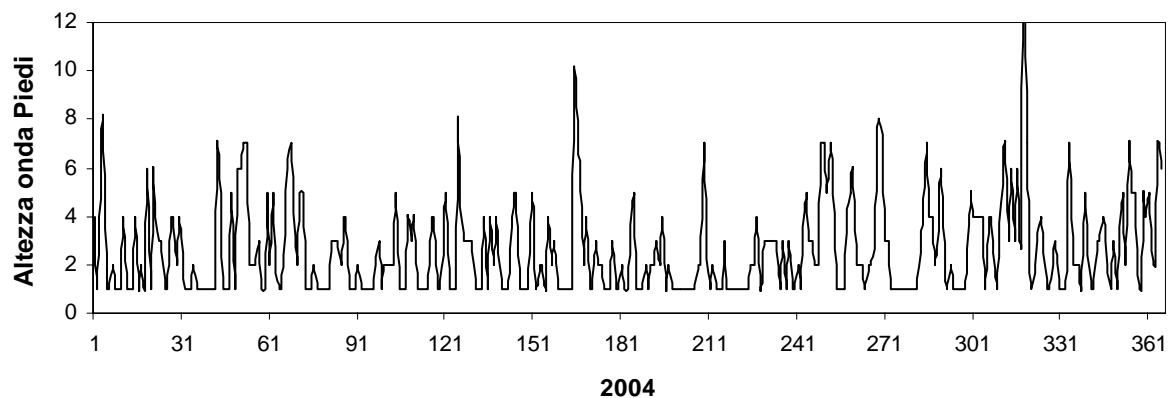


Fig 5 Altezza onda rilevata nelle piattaforme metanifere AGIP "Garibaldi C/Cervia B"

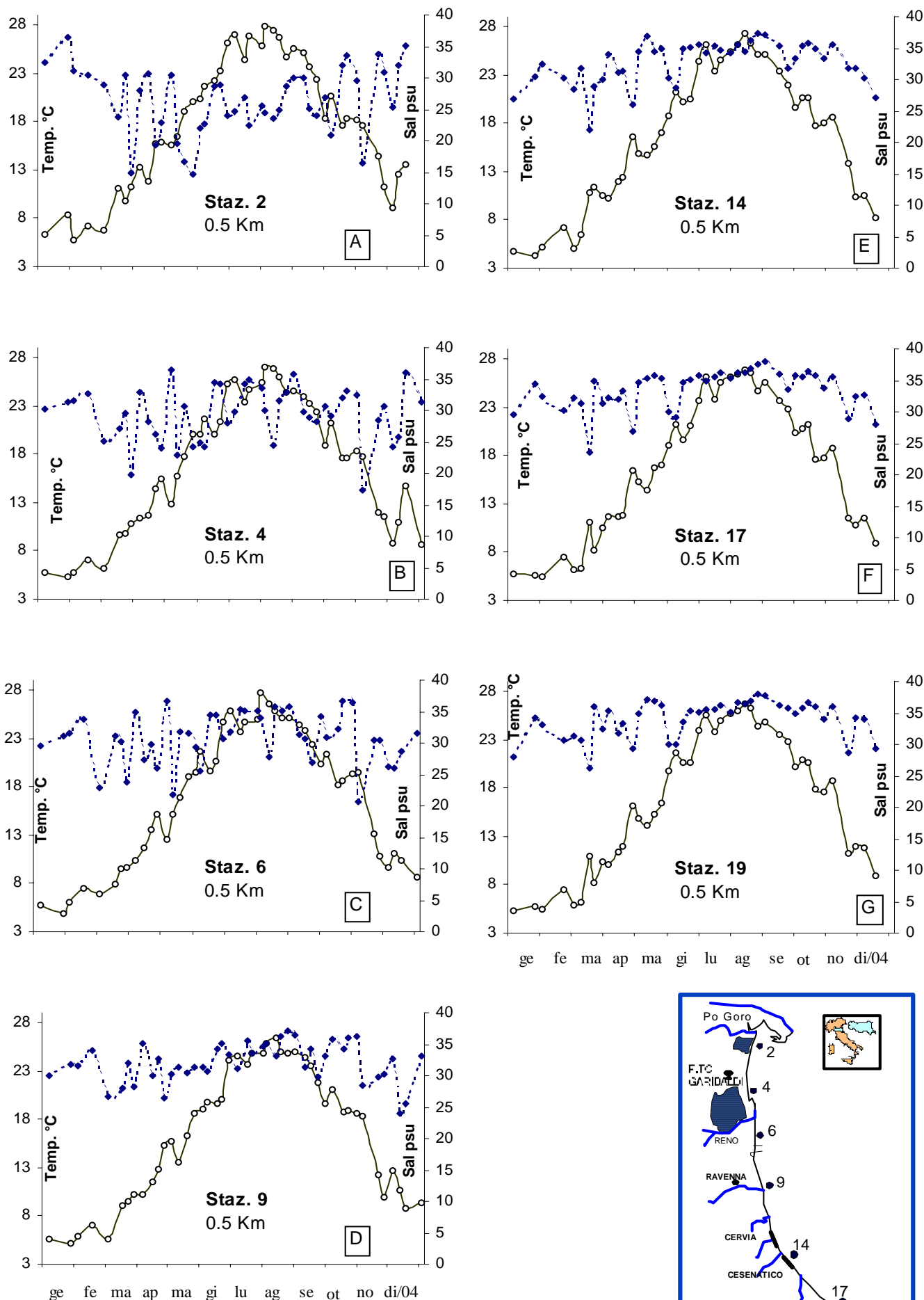


Fig 6 Andamenti temporali della Temperatura (linea continua) e della Salinità (linea tratteggiata) in superficie nelle stazioni a 0.5 Km dalla costa

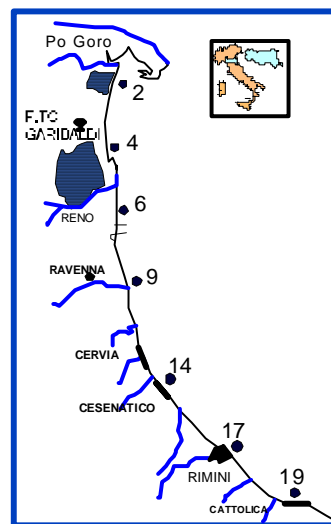
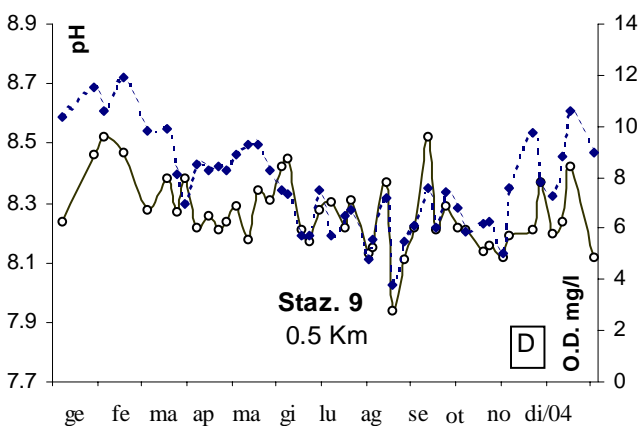
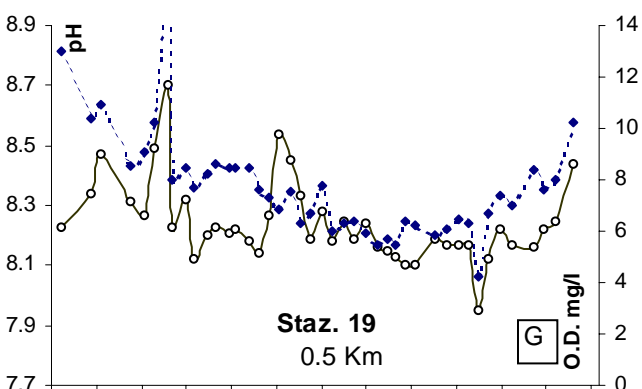
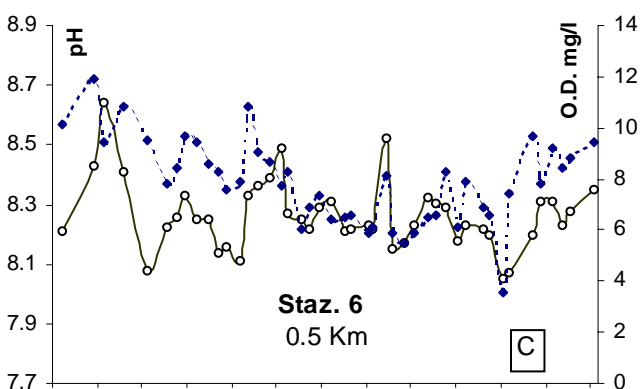
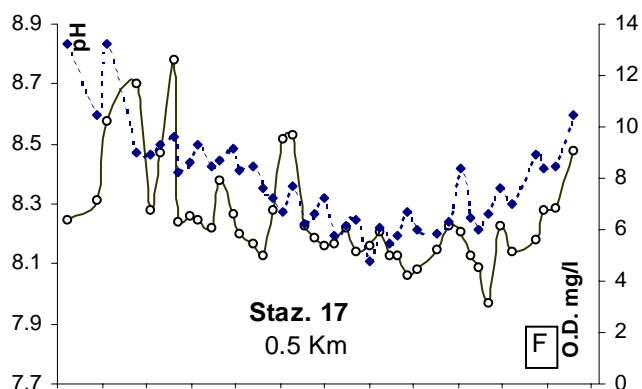
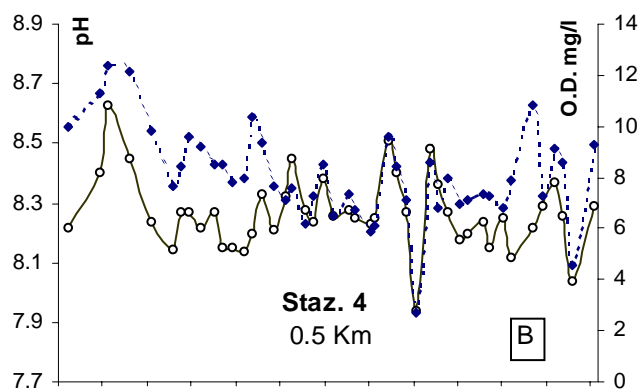
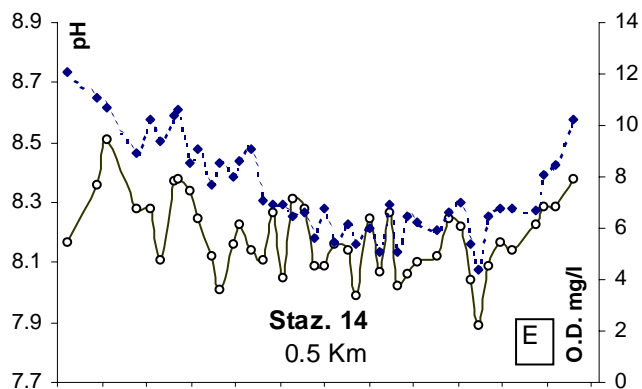
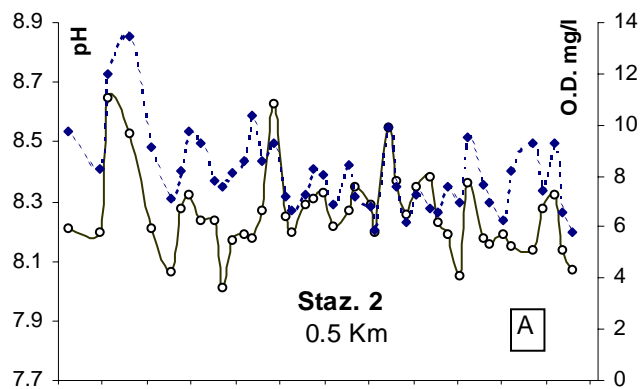


Fig 7 Andamenti temporali dell'Ossigeno Disciolto (linea tratteggiata) e del pH (linea continua) in superficie nelle stazioni a 0.5 Km dalla costa

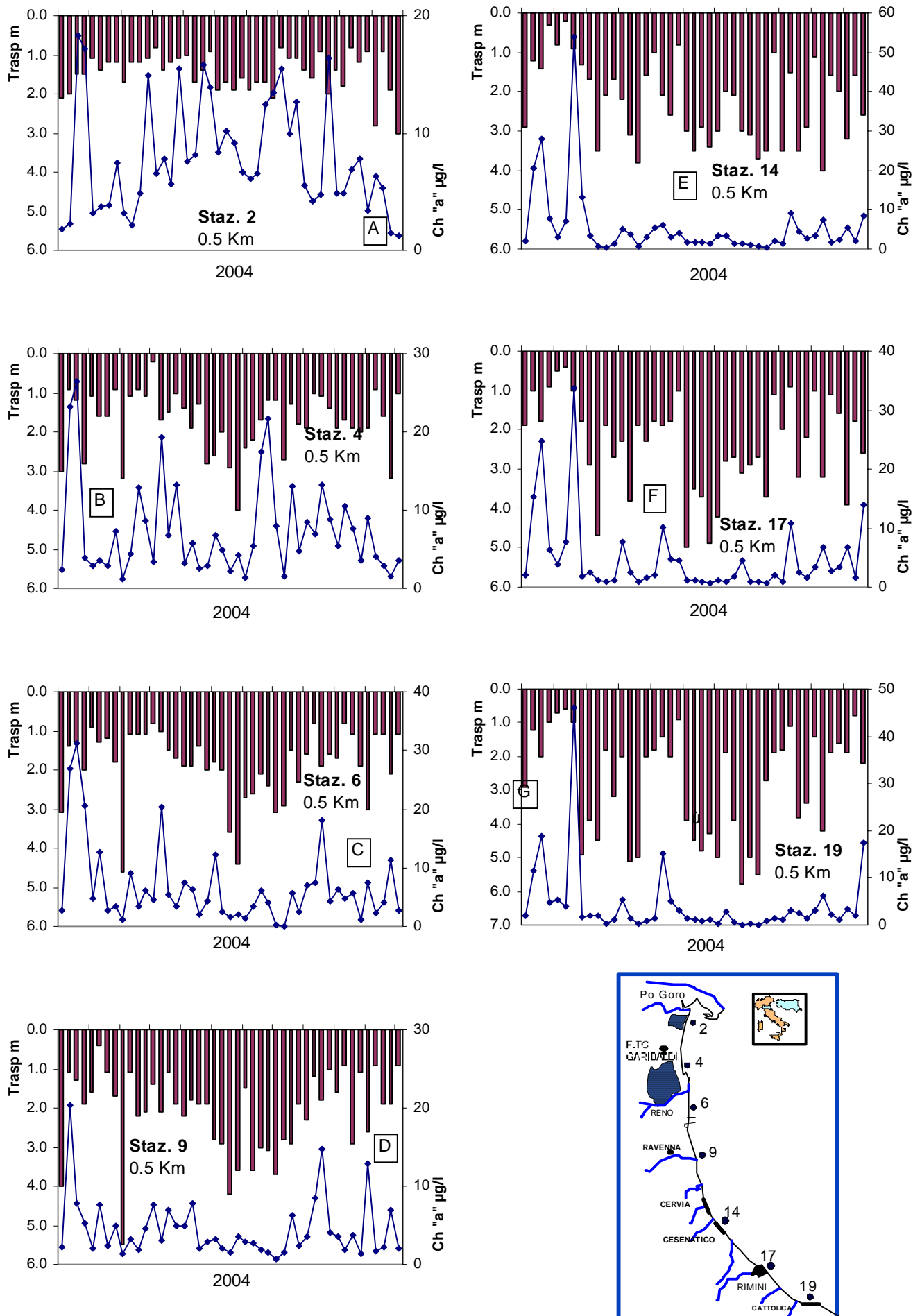


Fig 8 Andamenti temporali della Clorofilla "a" (linea continua) e della trasparenza (barre verticali) in superficie nelle stazioni a 0.5 Km dalla costa

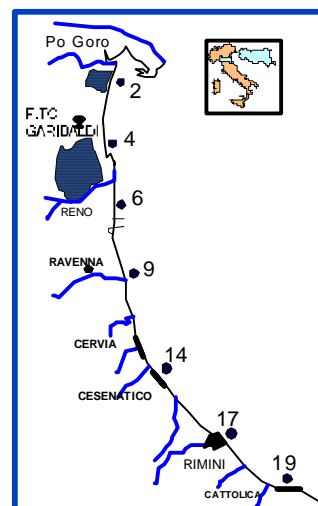
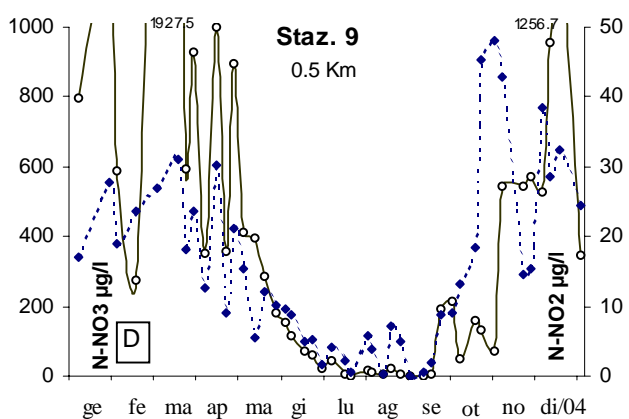
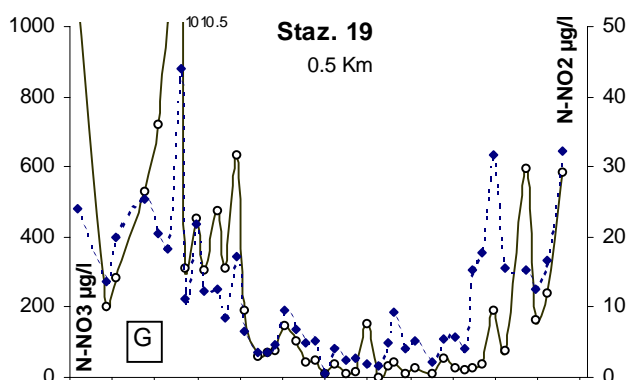
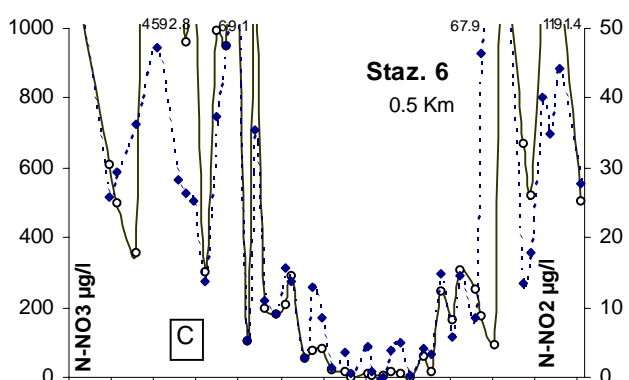
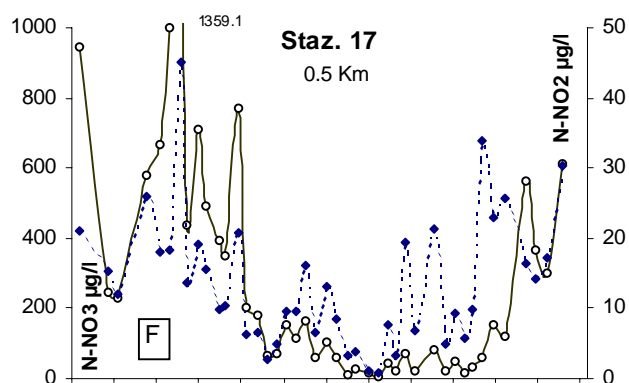
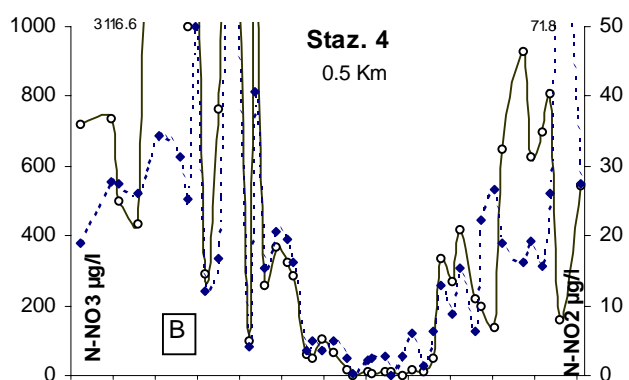
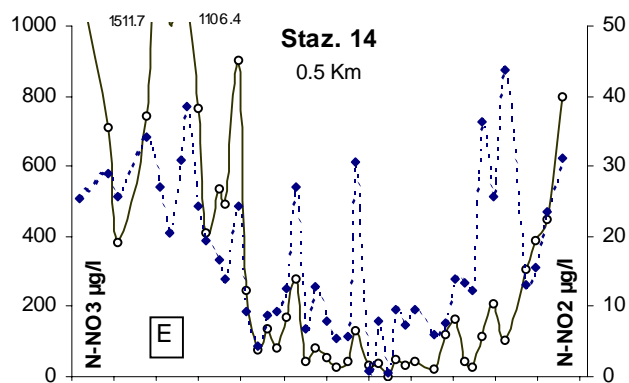
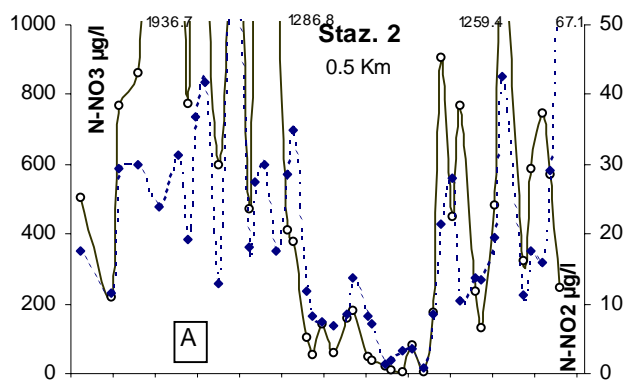


Fig. 9 Andamenti temporali del Nitrato N-NO₃ (linea continua) e del Nitrito N-NO₂ (linea tratteggiata) in superficie nelle stazioni a 0.5 Km dalla costa

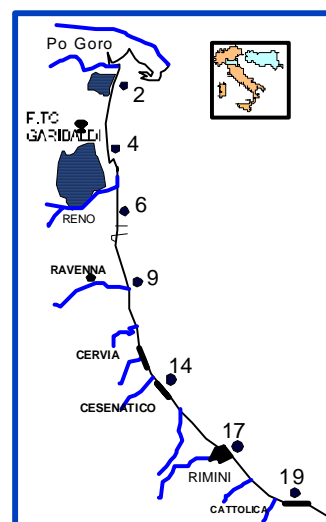
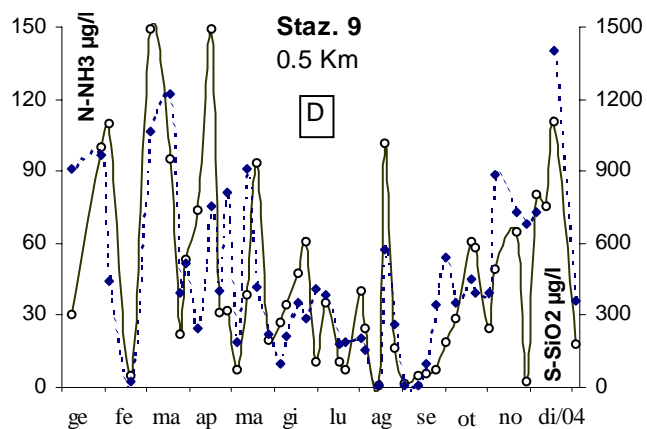
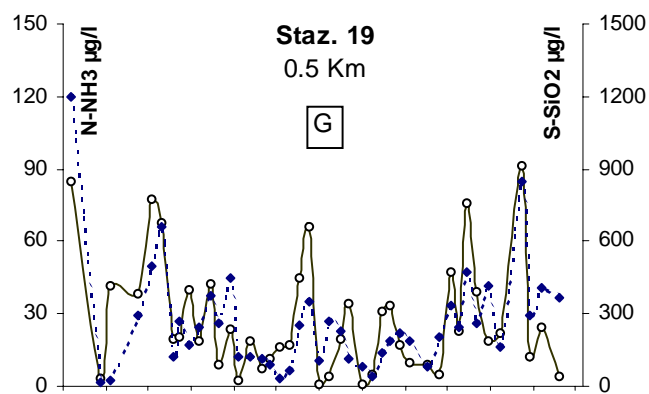
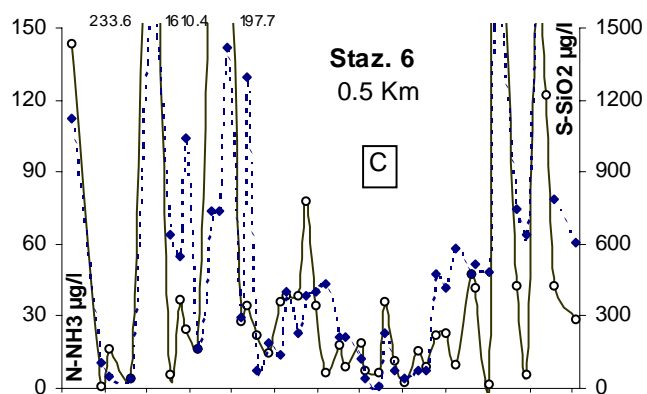
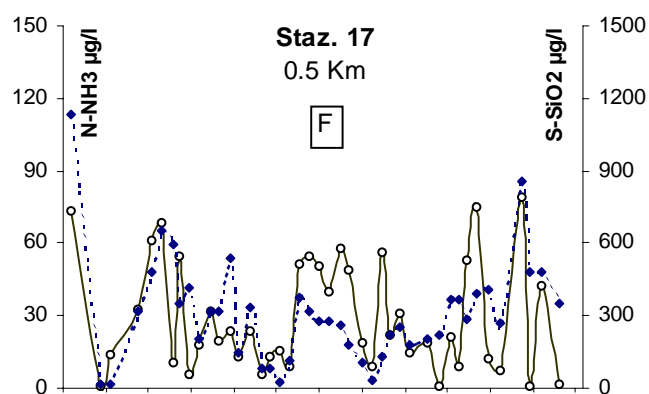
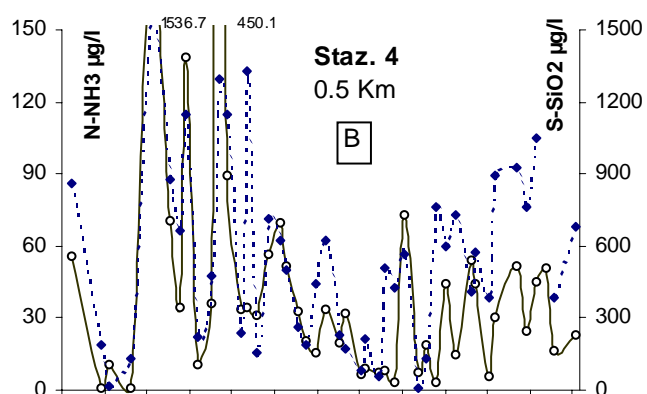
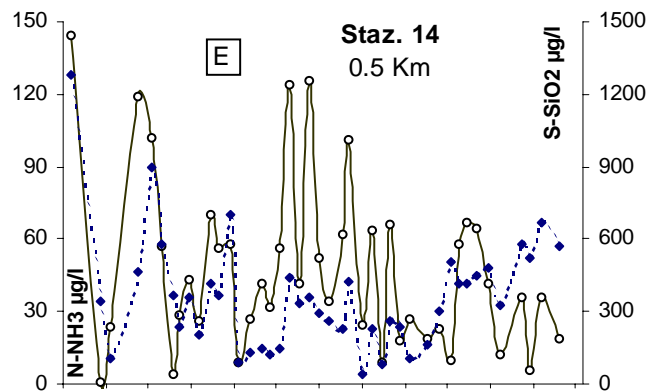
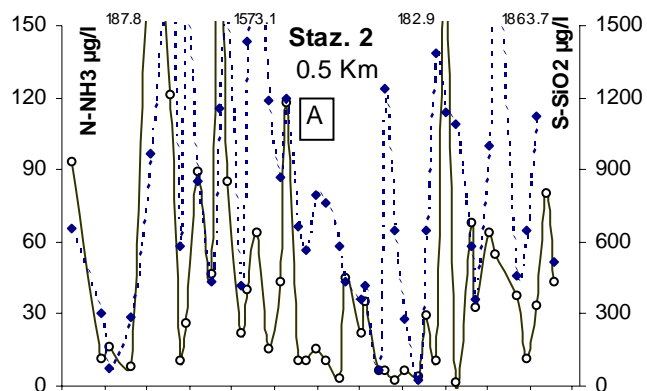


Fig 10 Andamenti temporali dell' Azoto Ammoniacale N-NH₃ (linea continua) e della Silice Si-SiO₂ (linea tratteggiata) in superficie nelle stazioni a 0.5 Km dalla costa

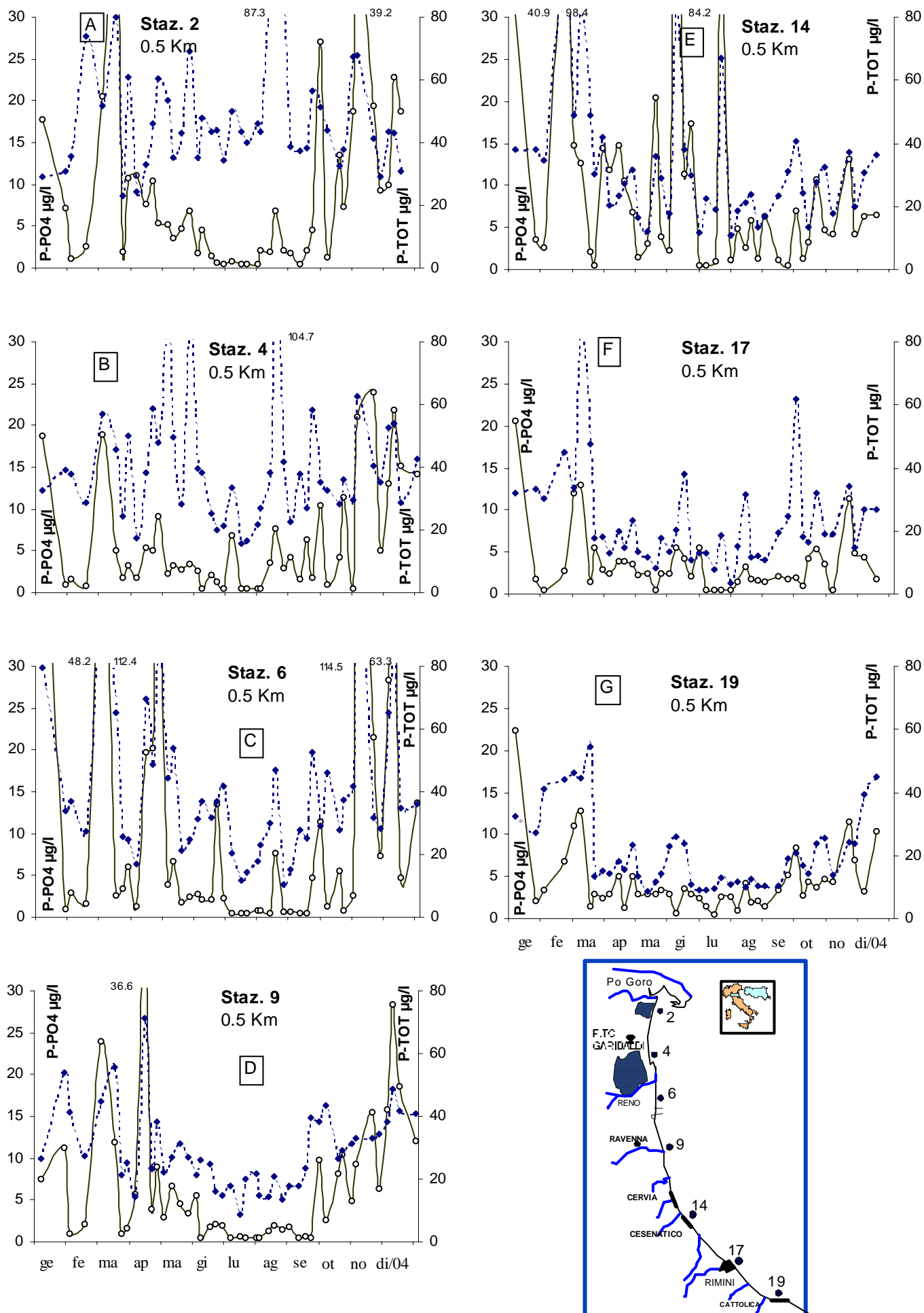


Fig 11 Andamenti temporali del Fosforo reattivo P-PO4 (linea continua) e del fosforo totale P-TOT (linea tratteggiata) in superficie nelle stazioni a 0.5 Km dalla costa

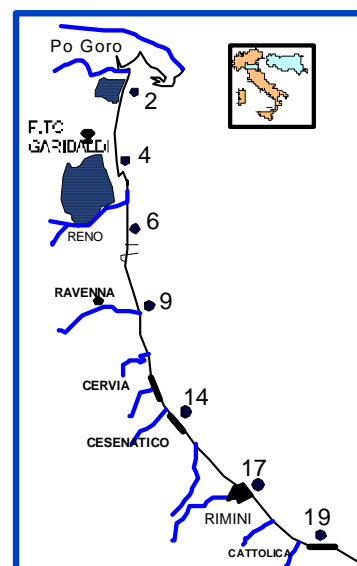
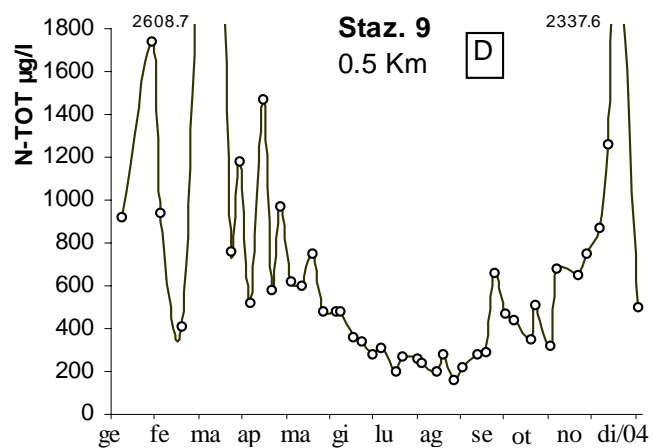
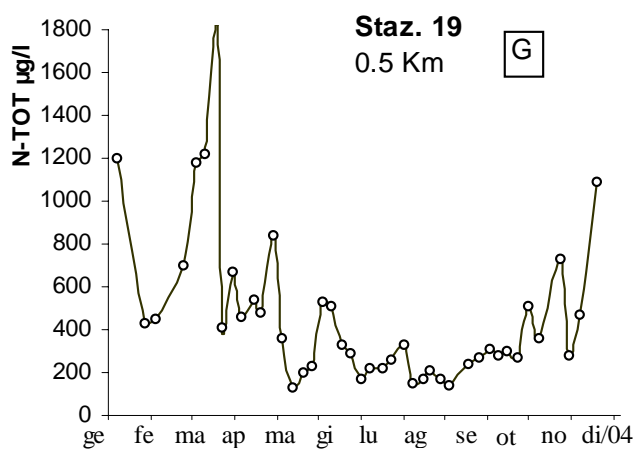
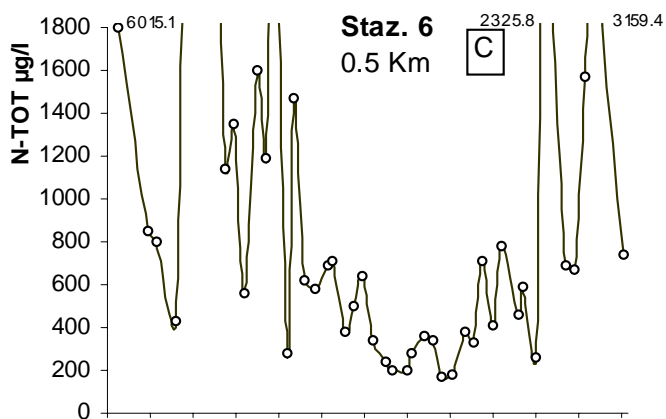
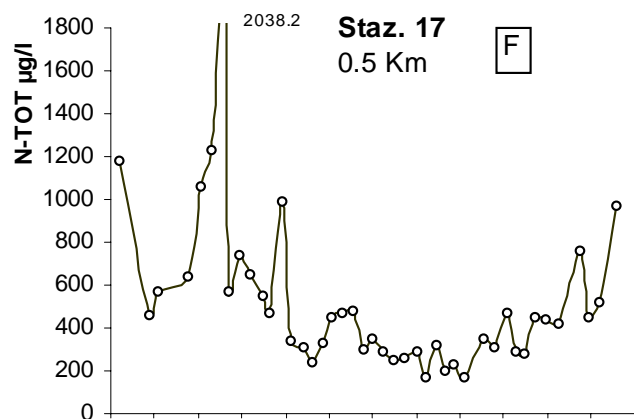
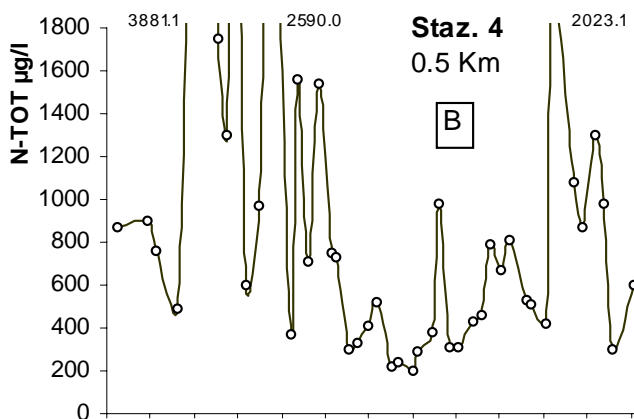
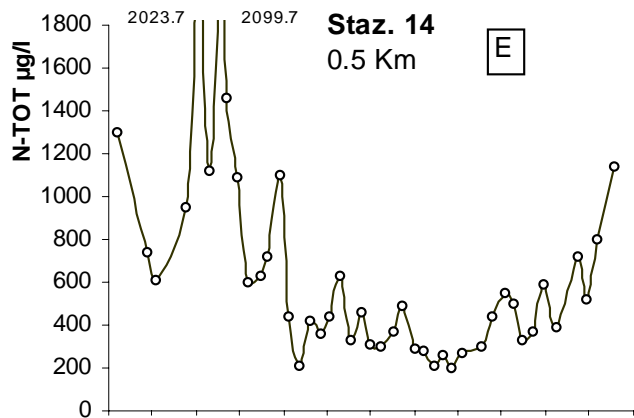
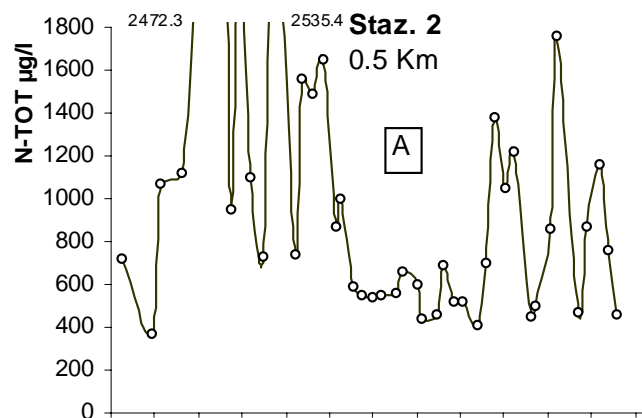


Fig 12 Andamenti temporali dell' Azoto totale N-TOT in superficie nelle stazioni a 0.5 Km dalla costa

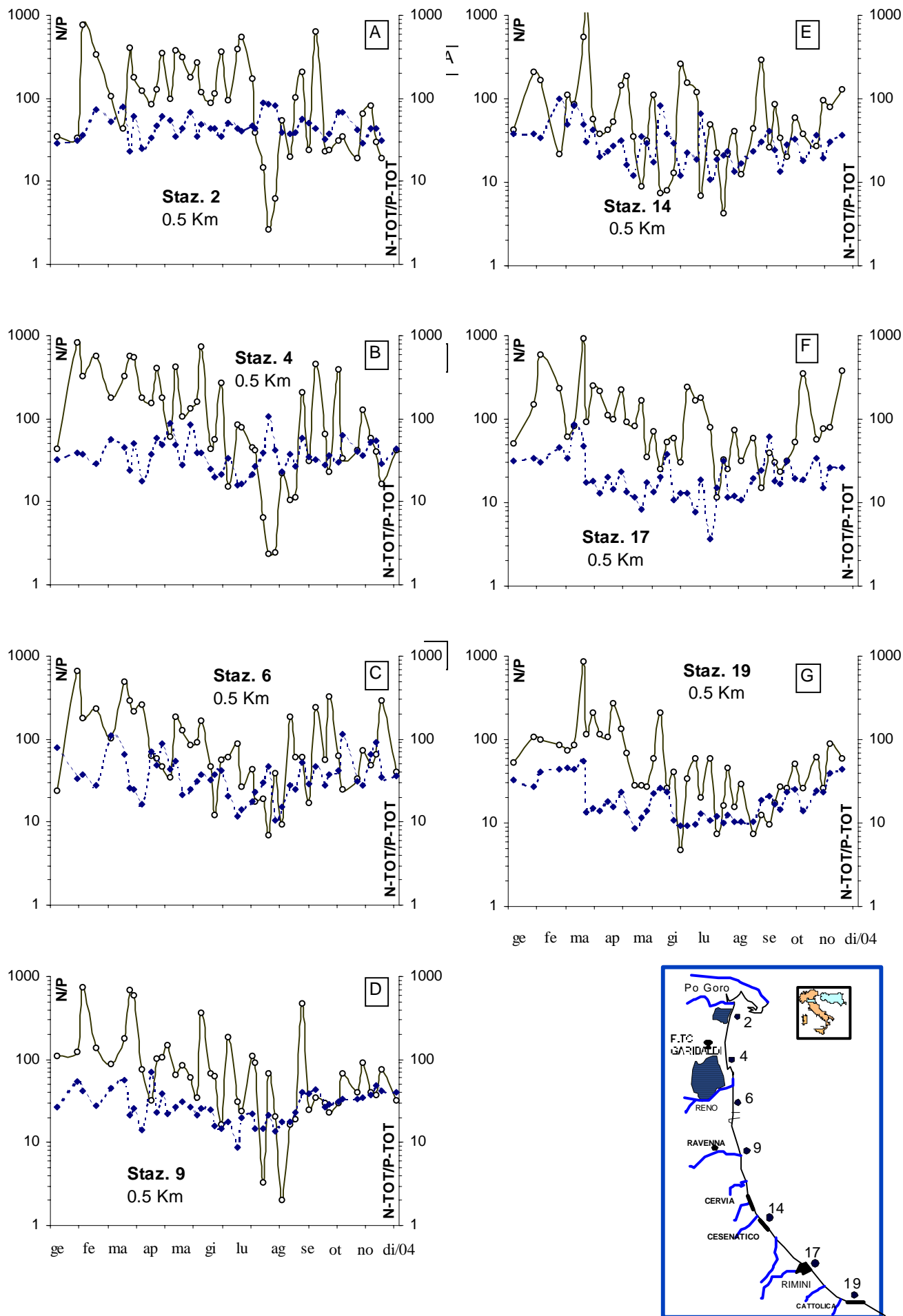


Fig 13 Andamenti temporali del rapporto N/P (linea continua) e del rapporto $N-TOT/P-TOT$ (linea tratteggiata) in superficie nelle stazioni a 0.5 Km dalla costa

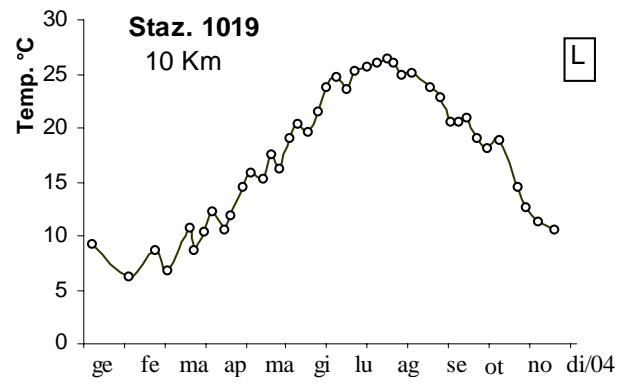
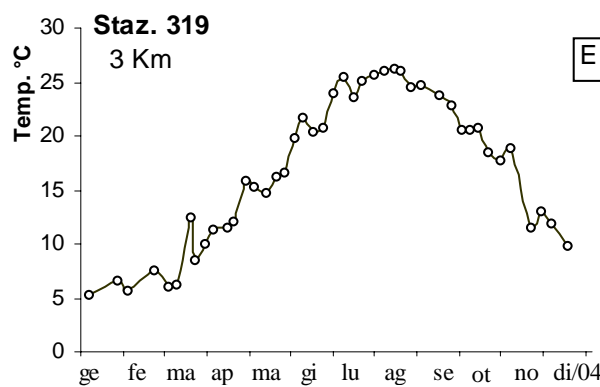
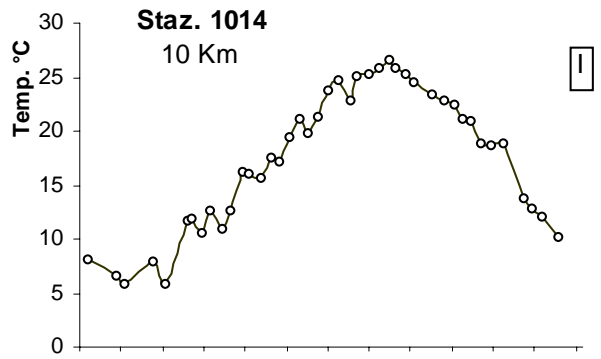
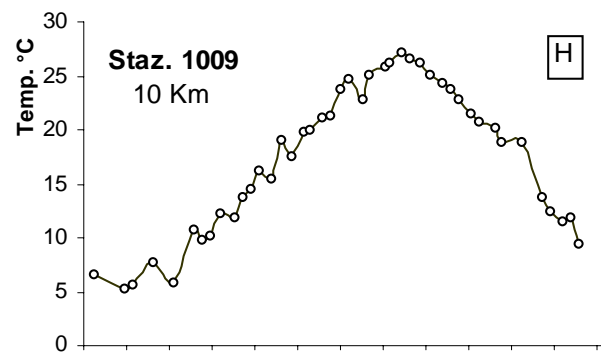
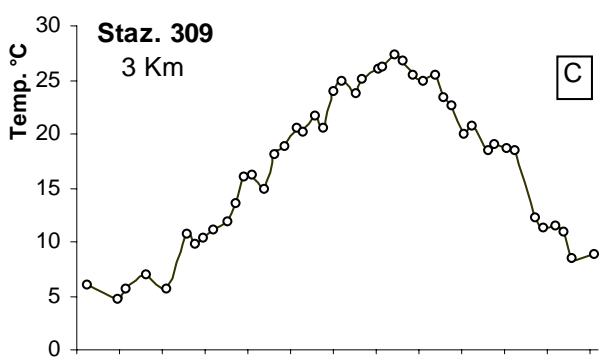
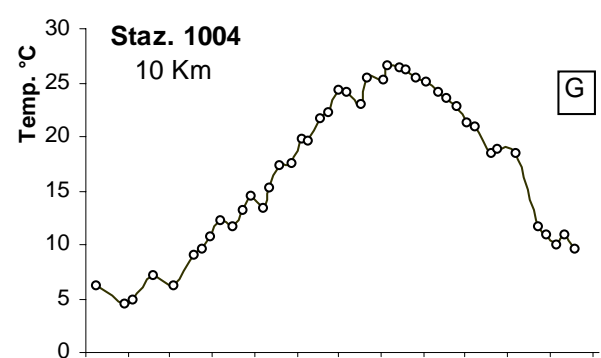
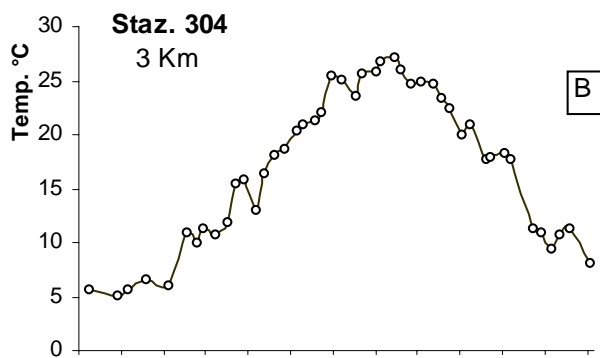
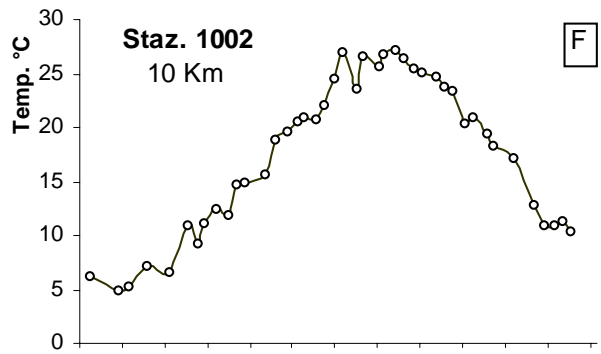
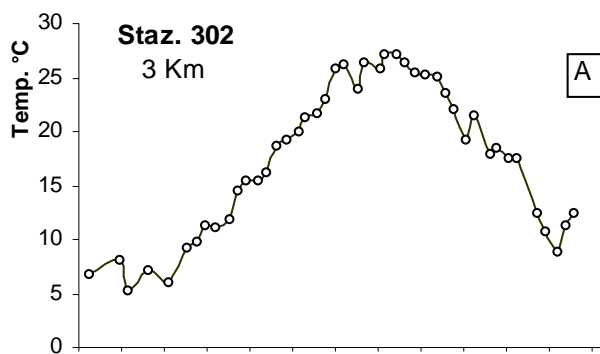


Fig 14 Andamenti temporali della Temperatura in superficie nelle stazioni a 3 e 10 Km dalla costa

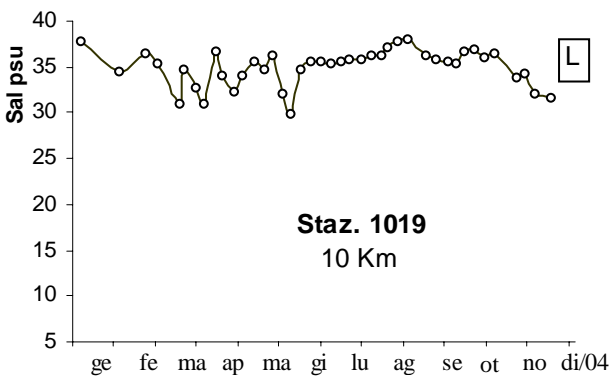
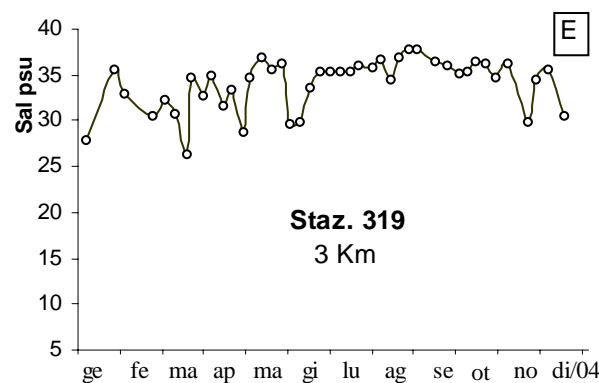
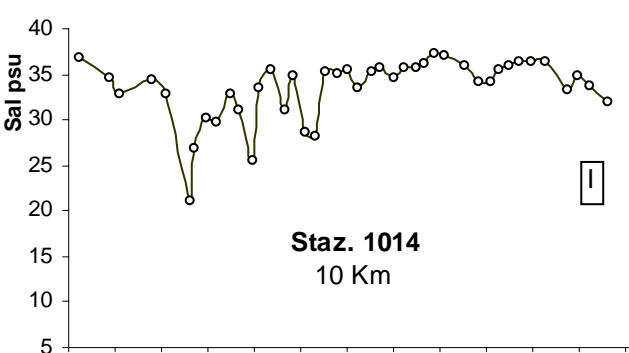
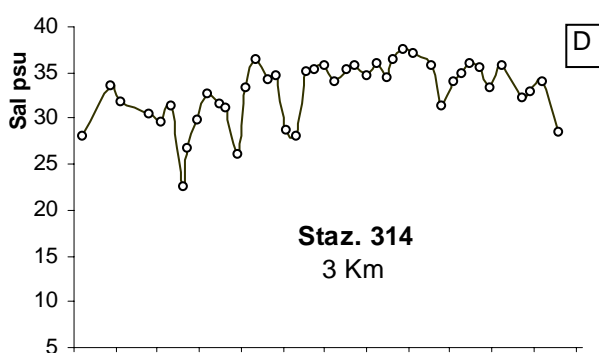
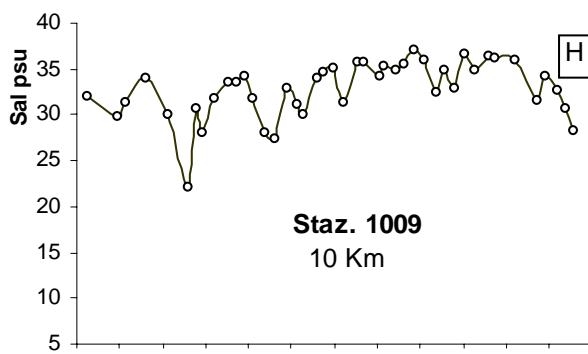
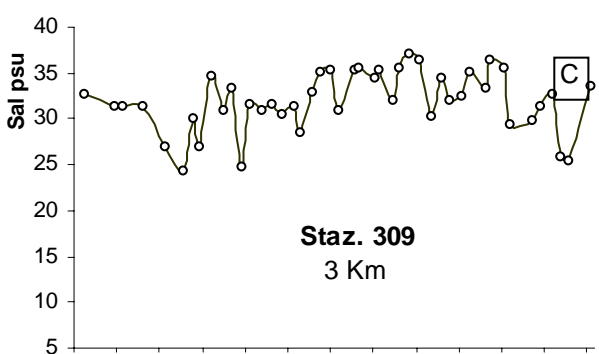
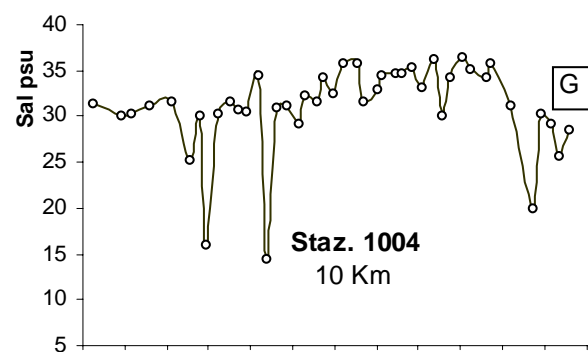
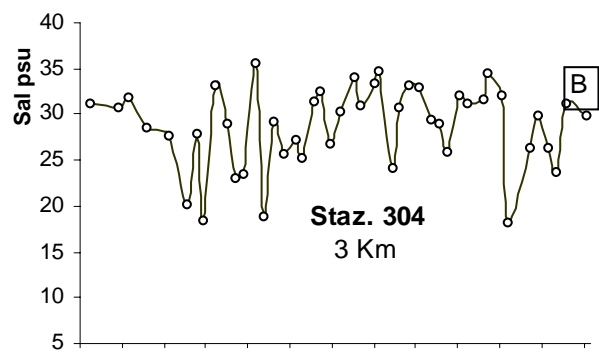
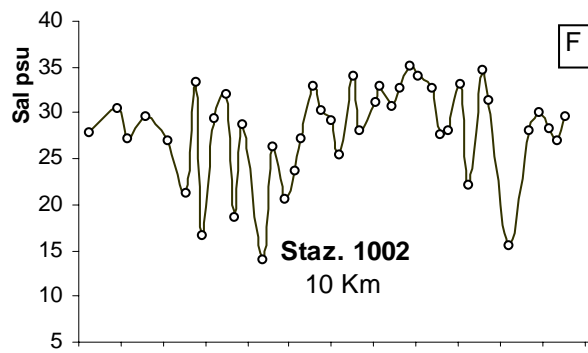
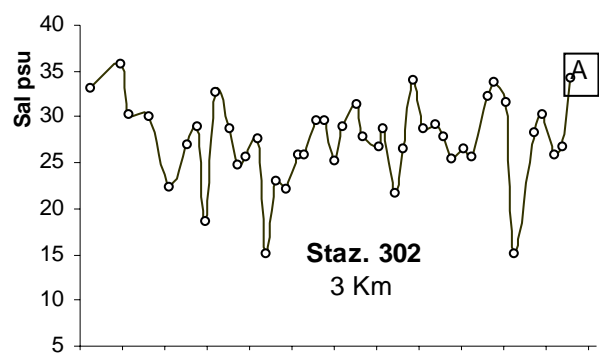


Fig 15 Andamenti temporali della Salinità in superficie nelle stazioni a 3 e 10 Km dalla costa

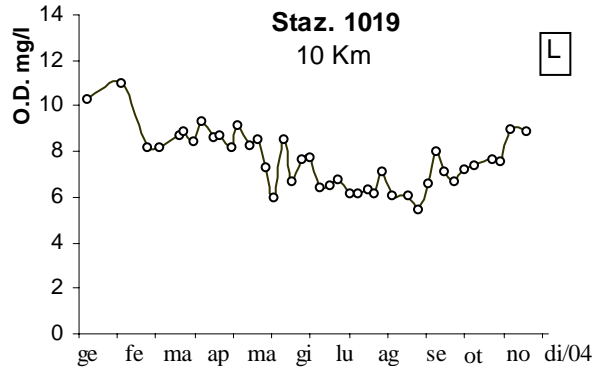
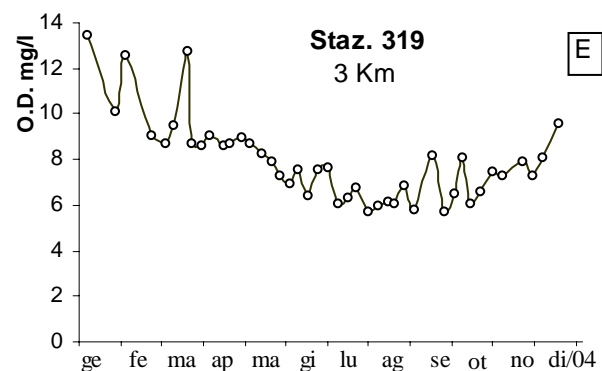
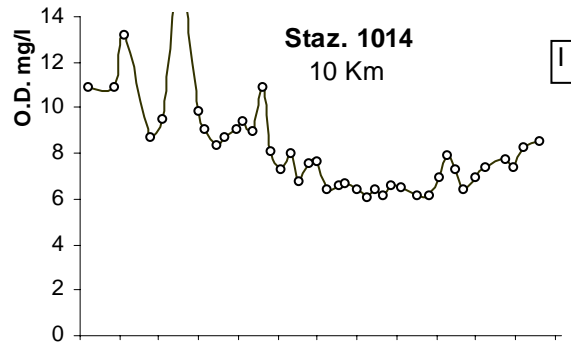
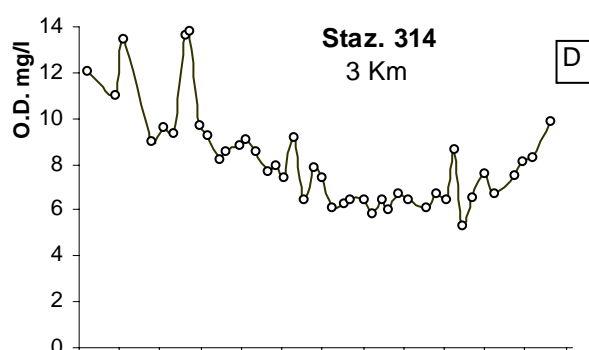
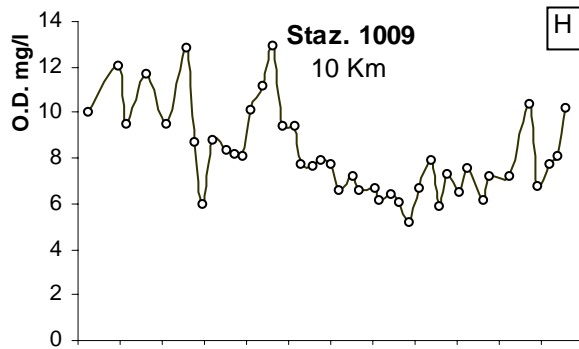
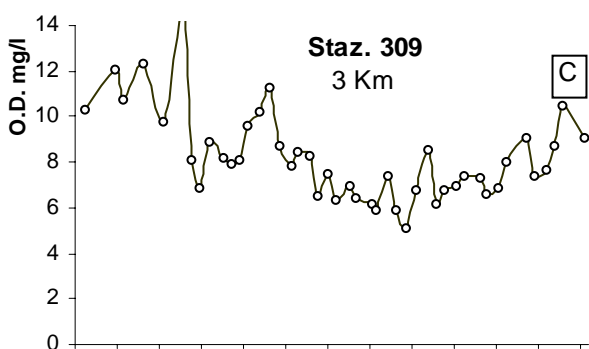
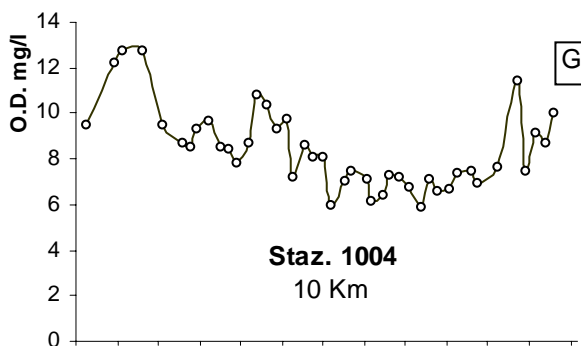
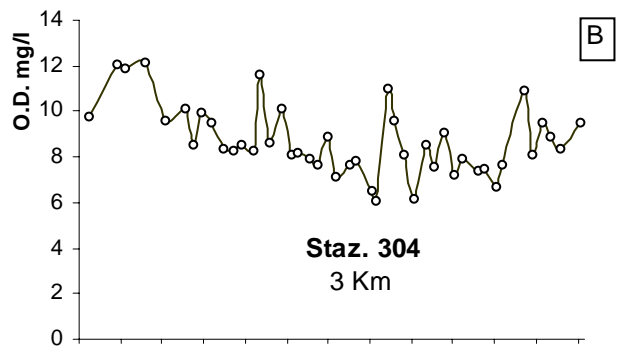
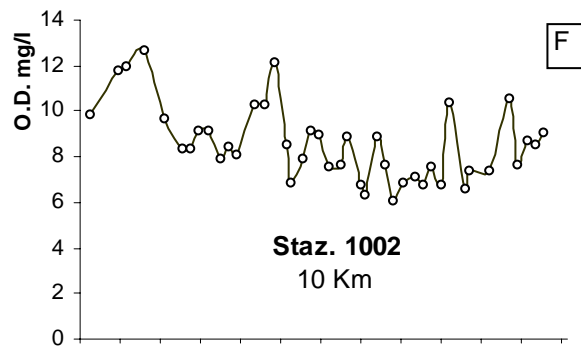
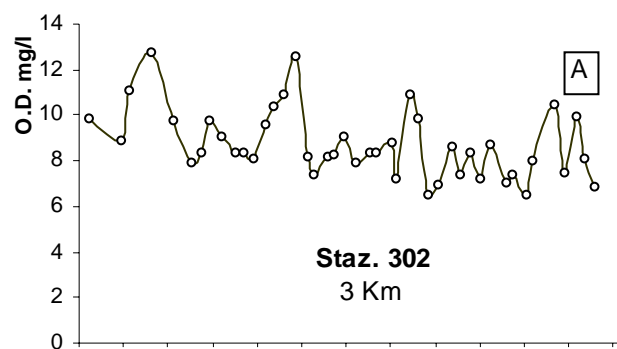


Fig 16 Andamenti temporali dell' Ossigeno in superficie nelle stazioni a 3 e 10 Km dalla costa

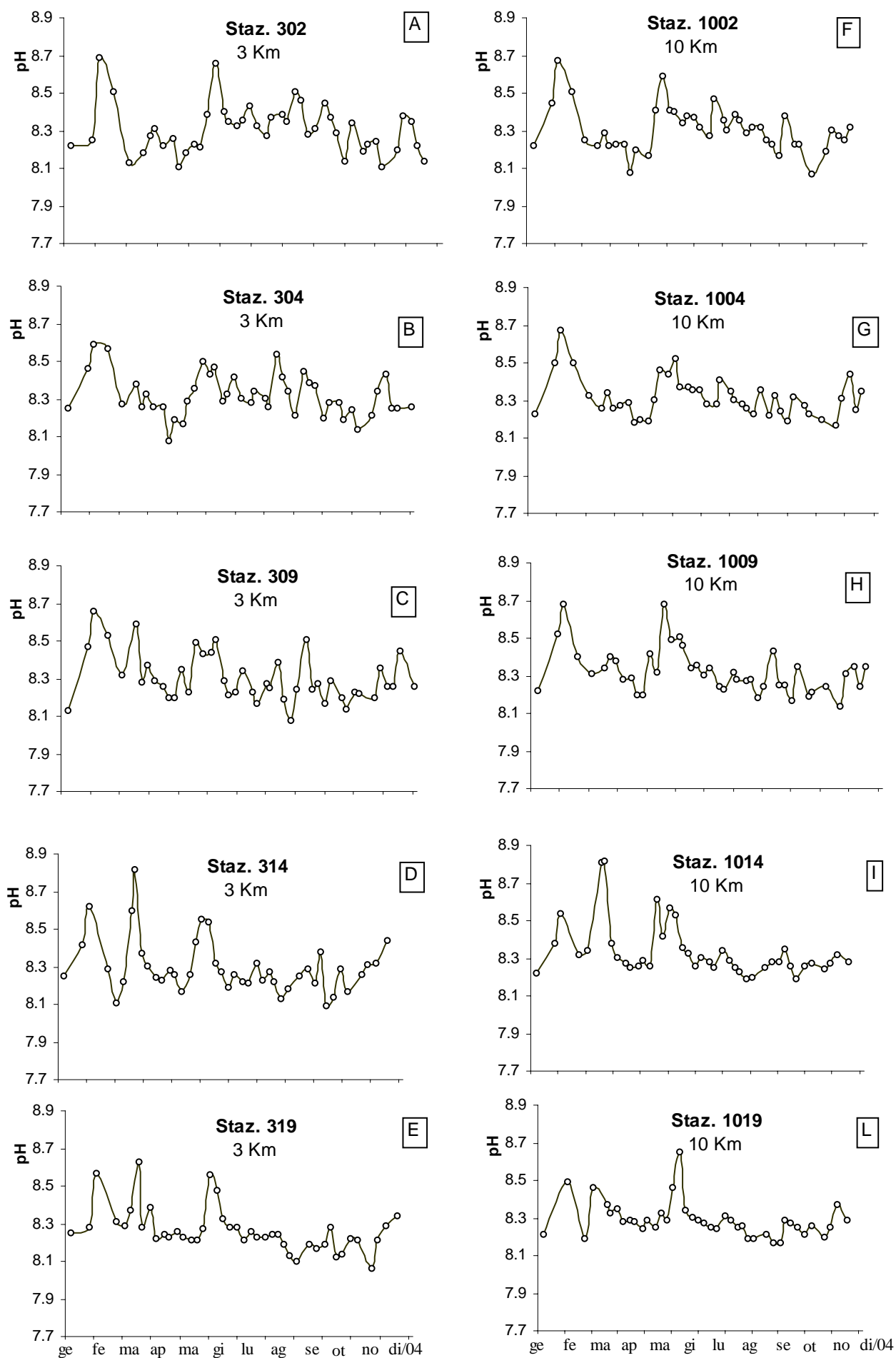


Fig 17 Andamenti temporali del pH in superficie nelle stazioni a 3 e 10 Km dalla costa

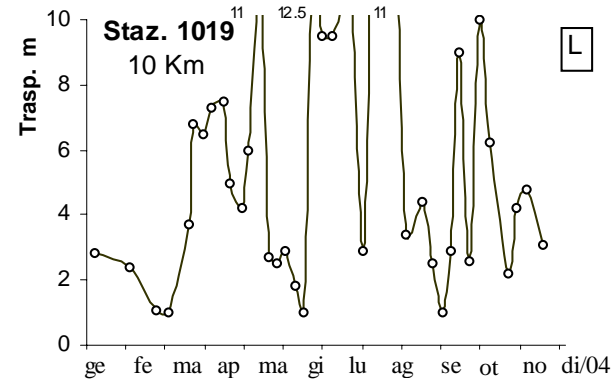
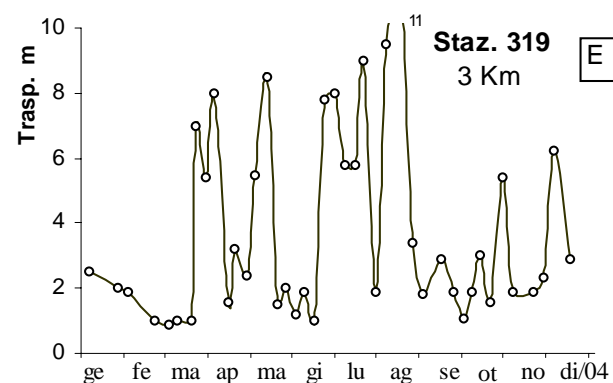
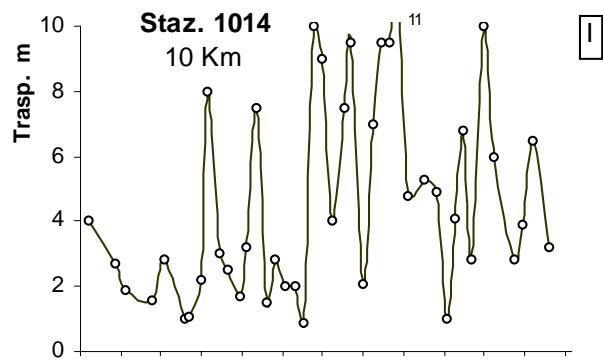
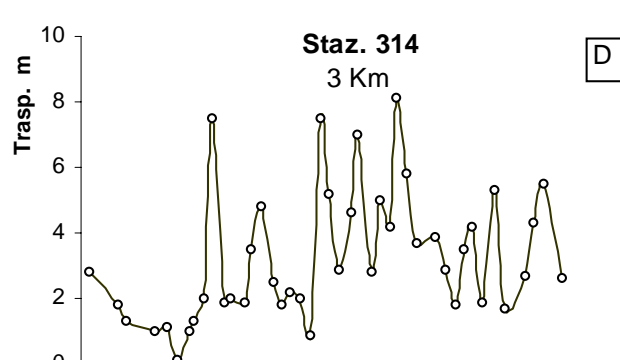
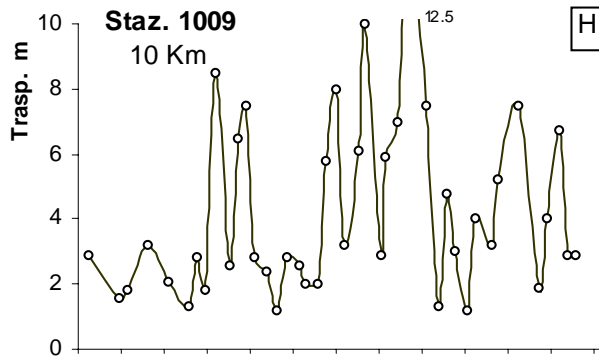
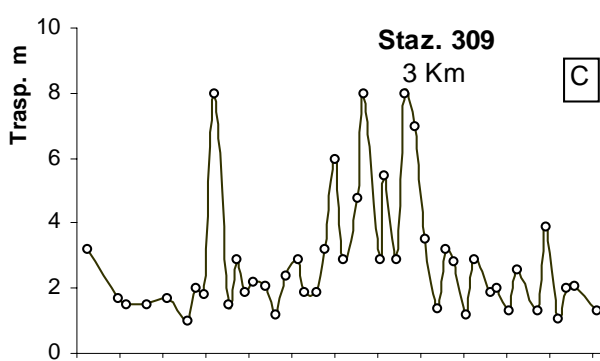
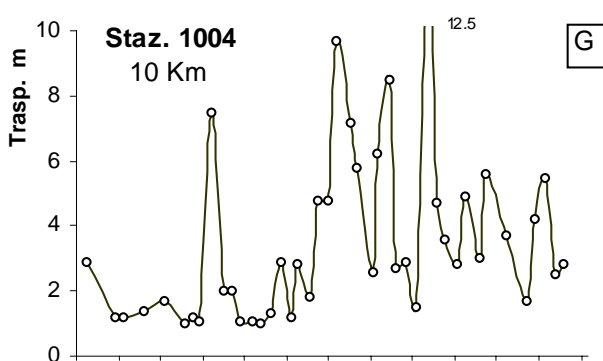
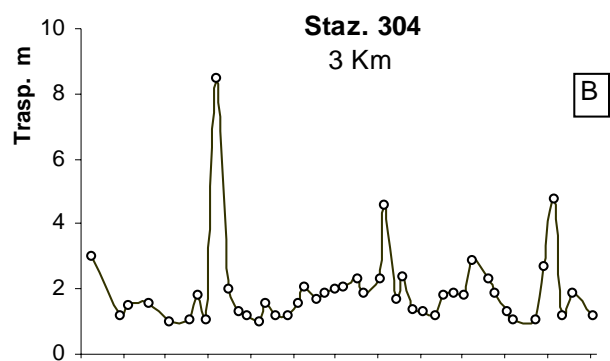
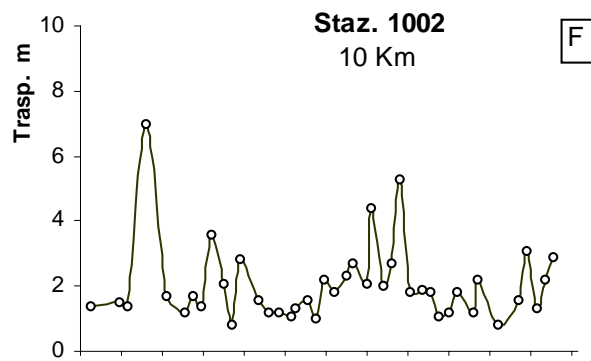
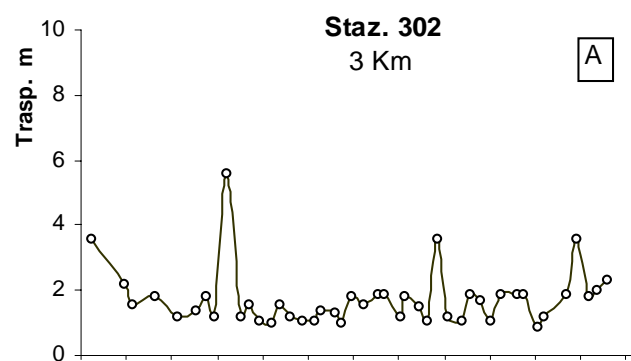


Fig 18 Andamenti temporali della Trasparenza nelle stazioni a 3 e 10 Km dalla costa

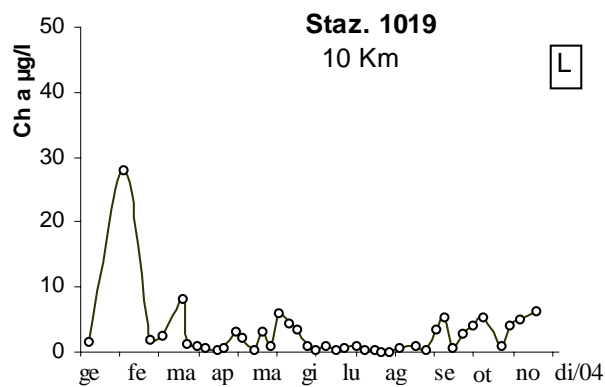
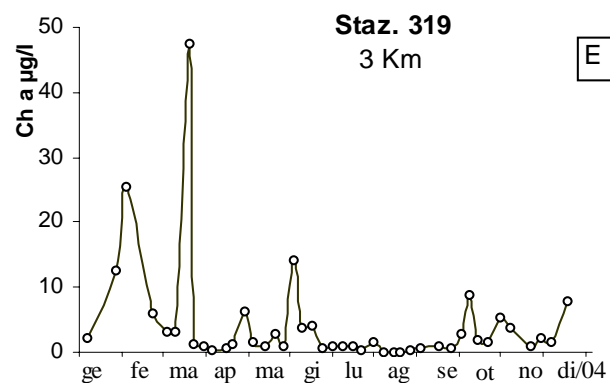
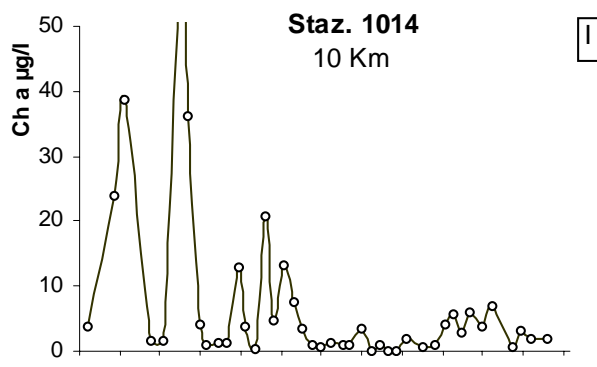
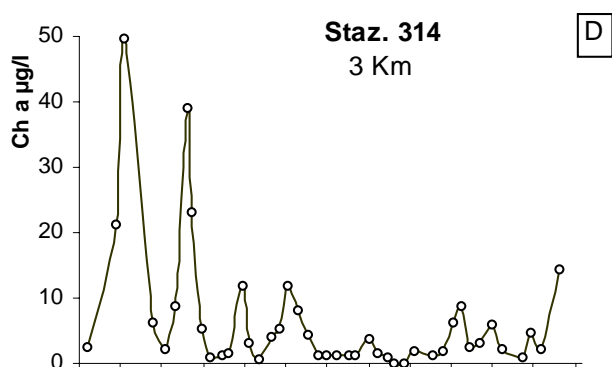
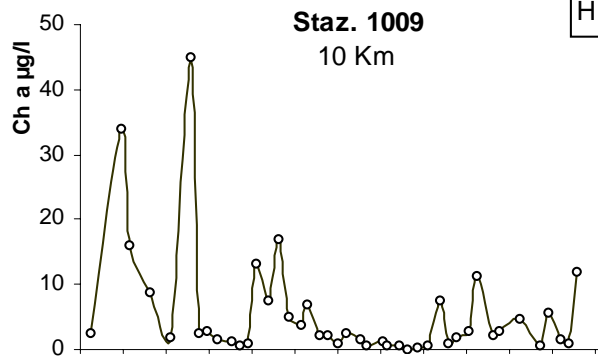
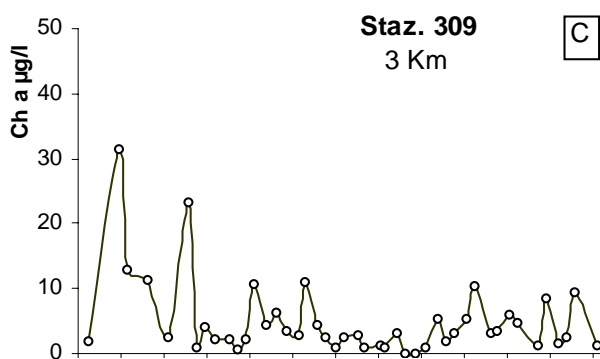
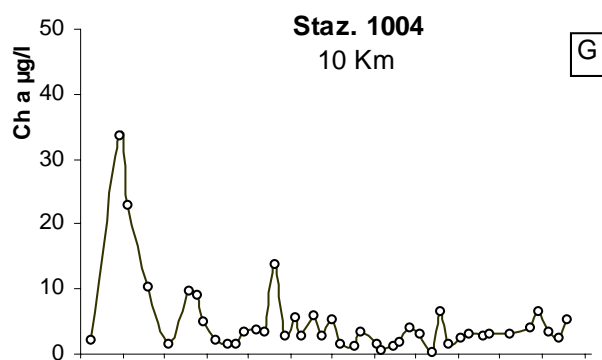
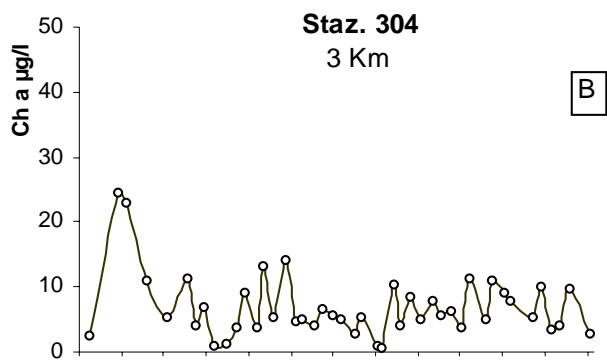
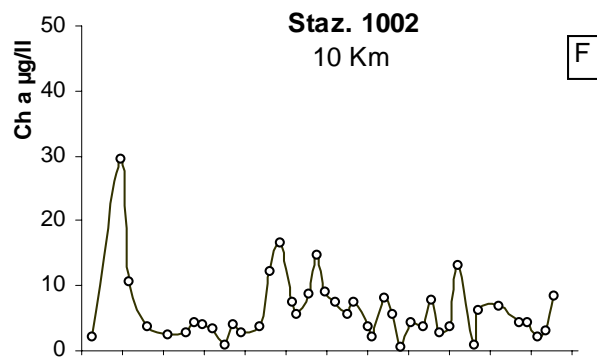
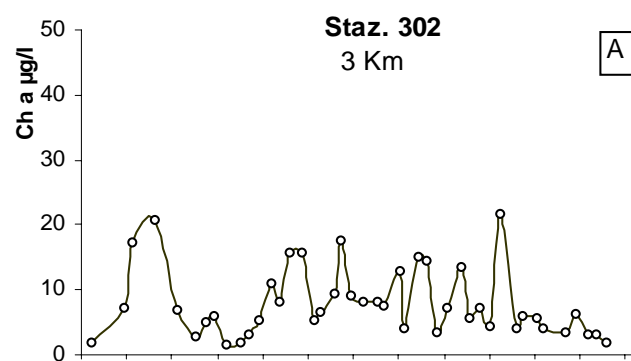


Fig 19 Andamenti temporali della Clorofilla "a" in superficie nelle stazioni a 3 e 10 Km dalla costa

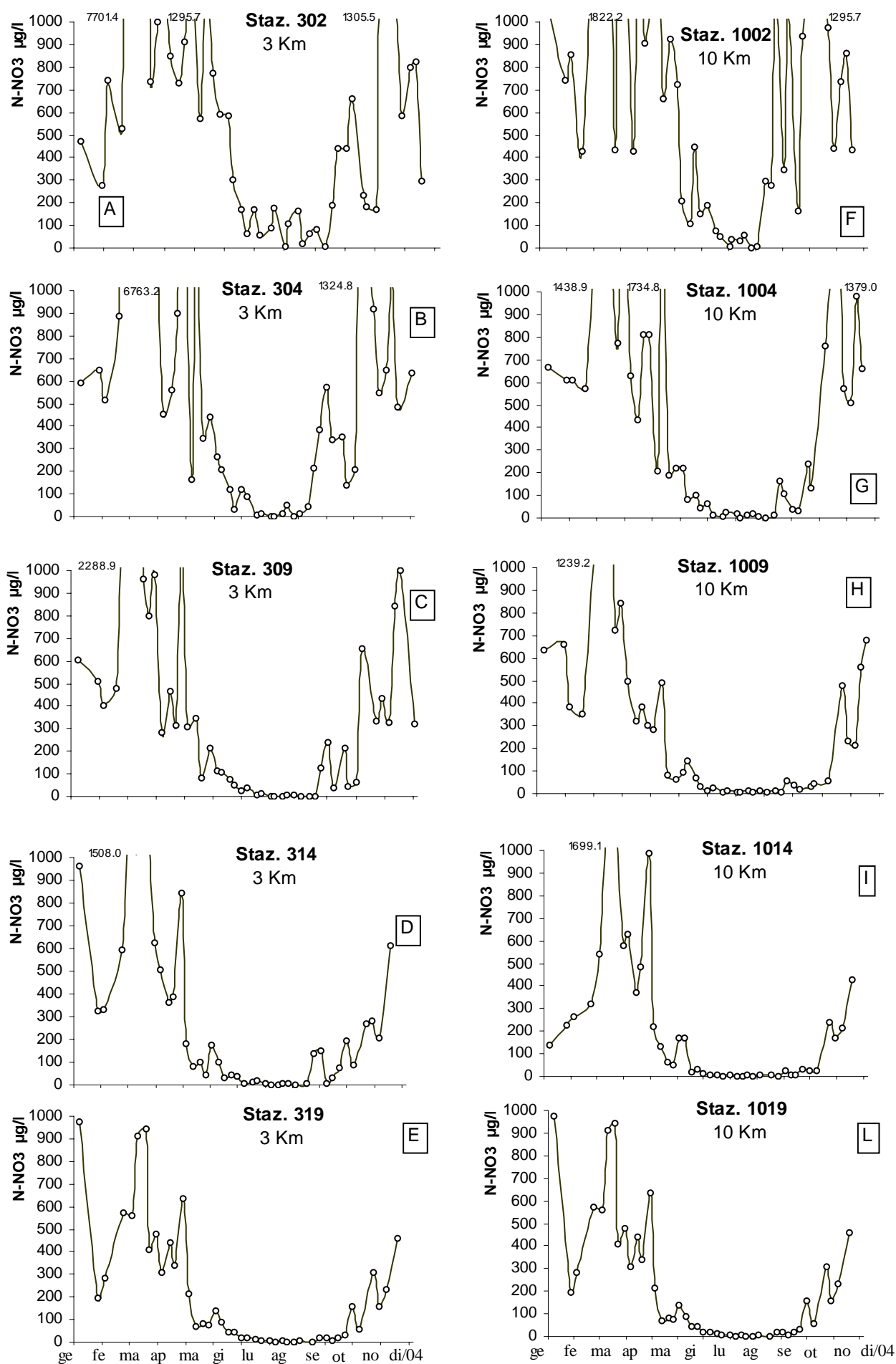


Fig. 20 Andamenti temporali del Nitrato N-NO₃ in superficie nelle stazioni a 3 e 10 Km dalla costa

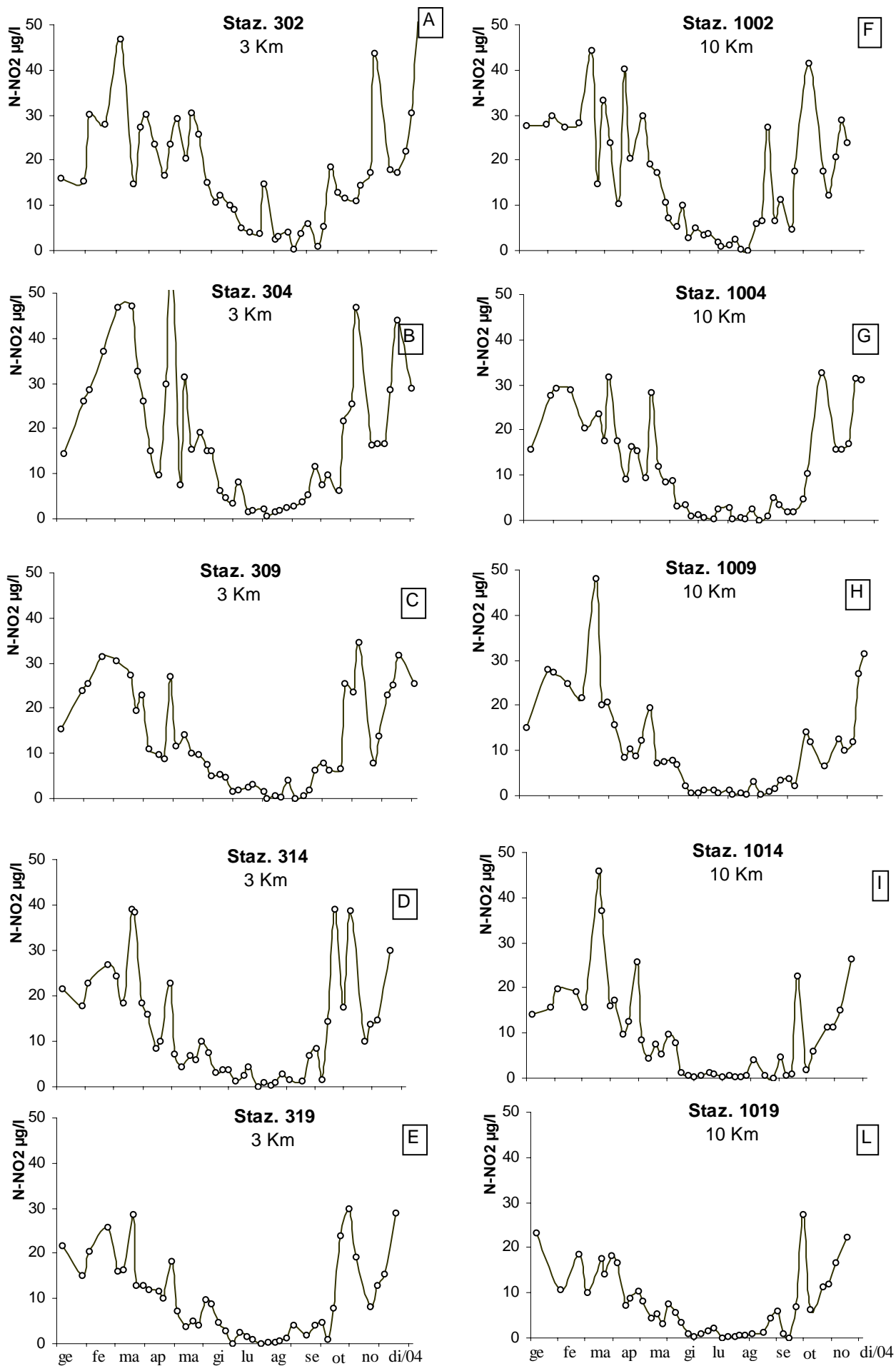


Fig. 21 Andamenti temporali del Nitrito N-NO₂ in superficie nelle stazioni a 3 e 10 Km dalla costa

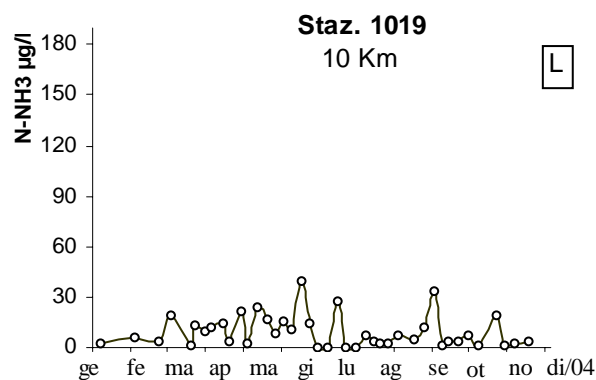
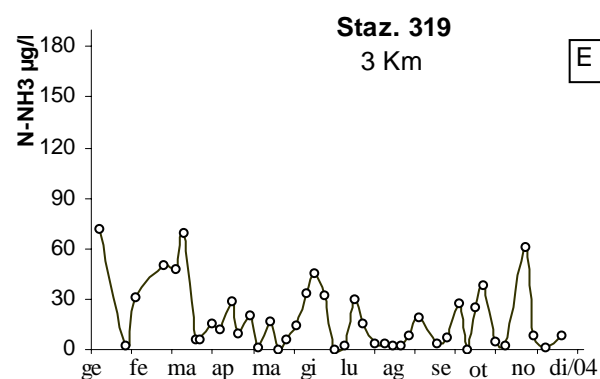
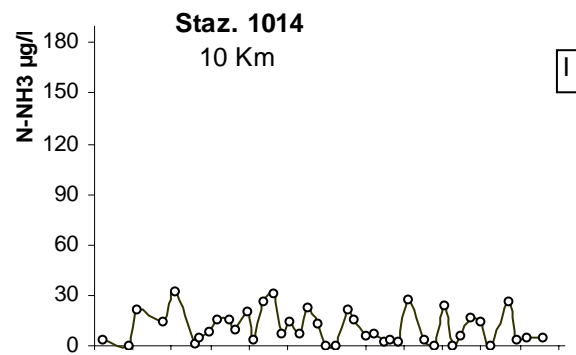
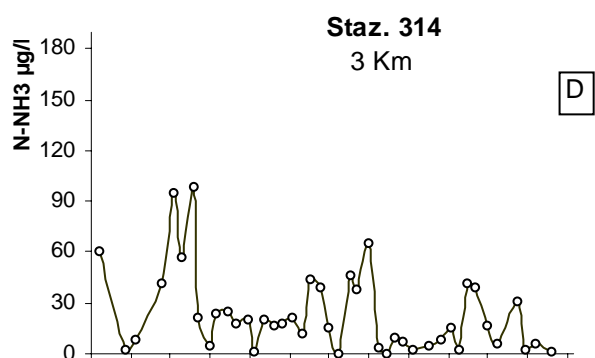
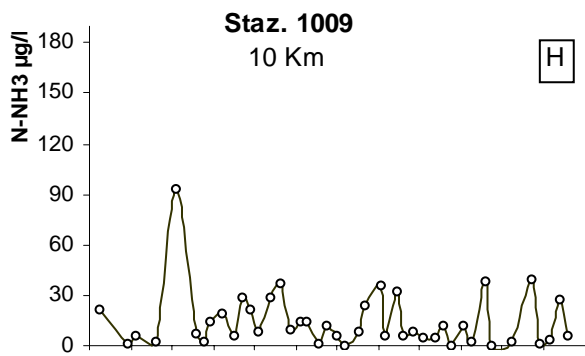
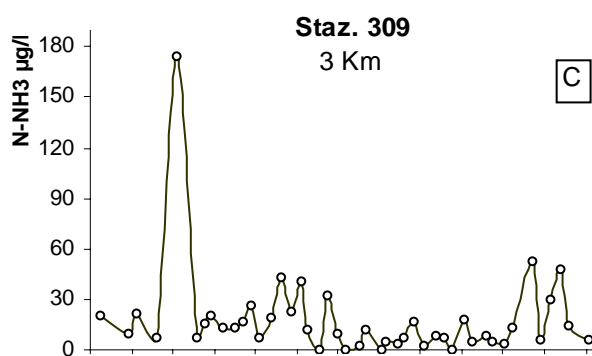
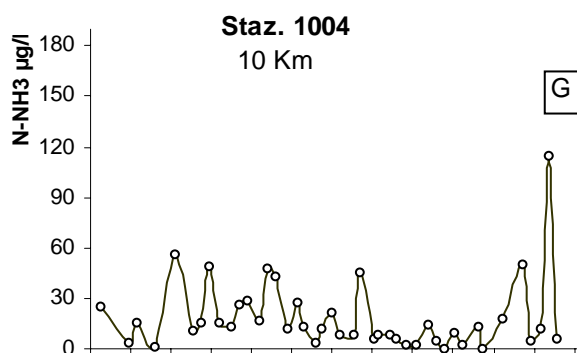
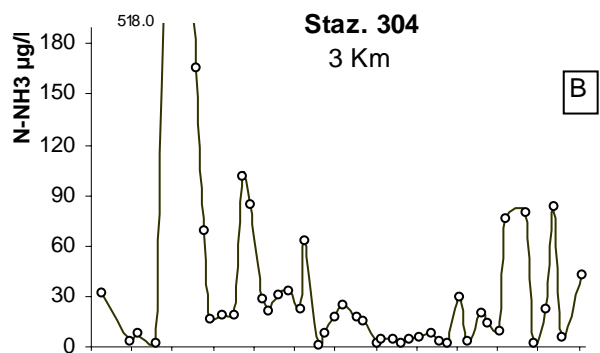
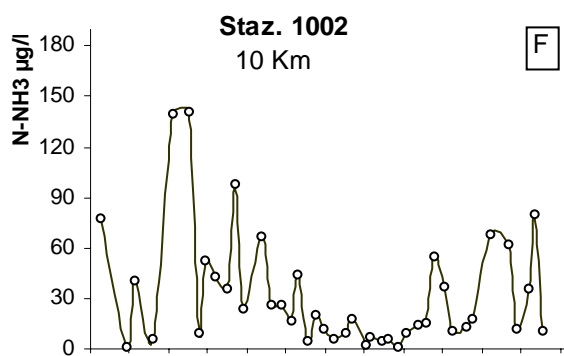
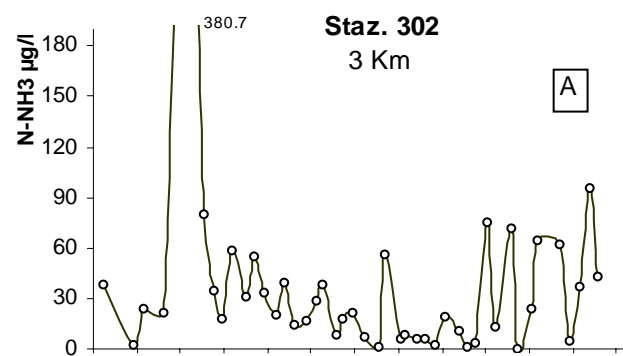


Fig 22 Andamenti temporali dell' Azoto ammoniacale N-NH₃ in superficie nelle stazioni a 3 e 10 Km dalla costa

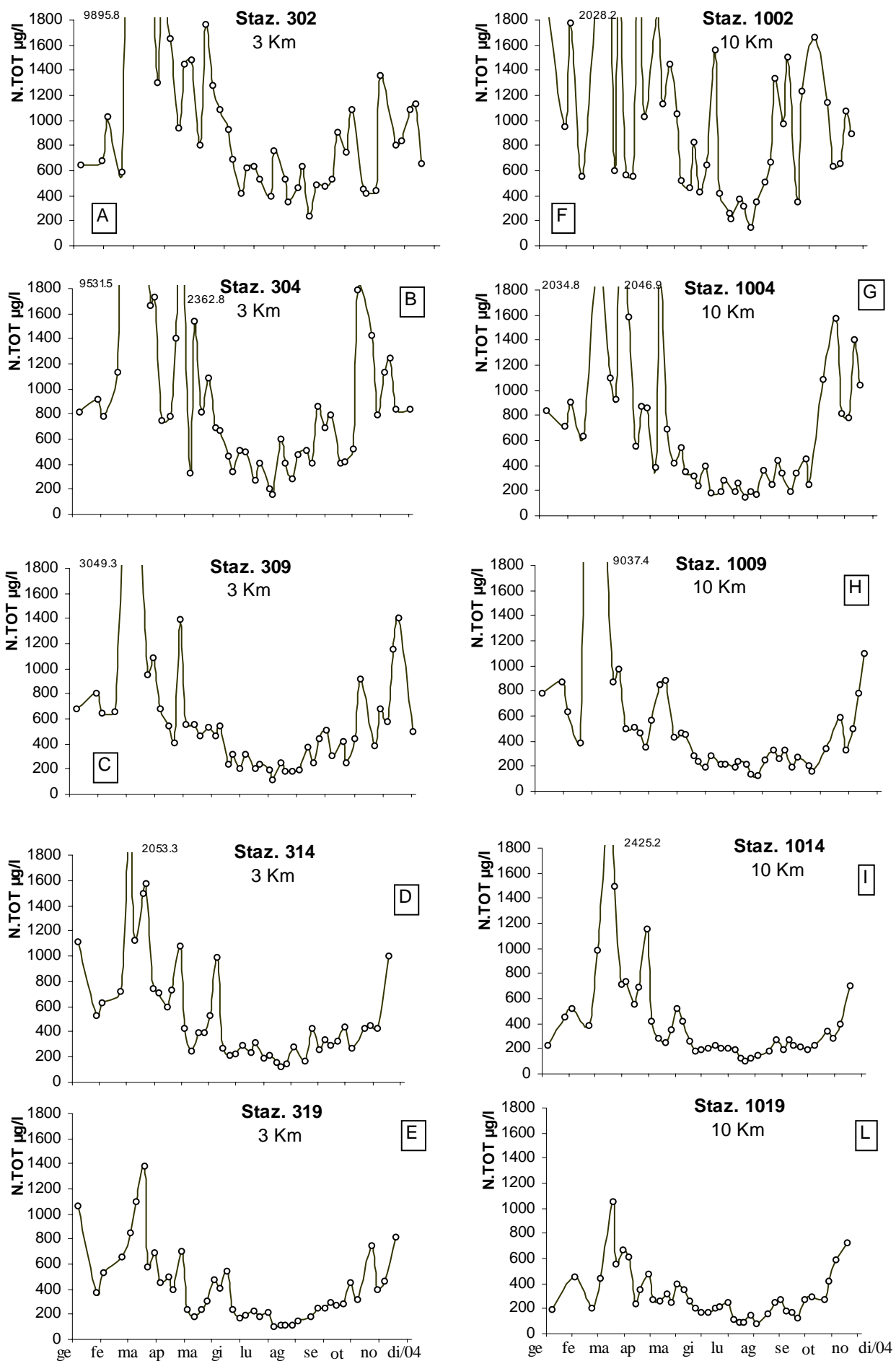


Fig 23 Andamenti temporali dell' Azoto totale in superficie nelle stazioni a 3 e 10 Km dalla costa

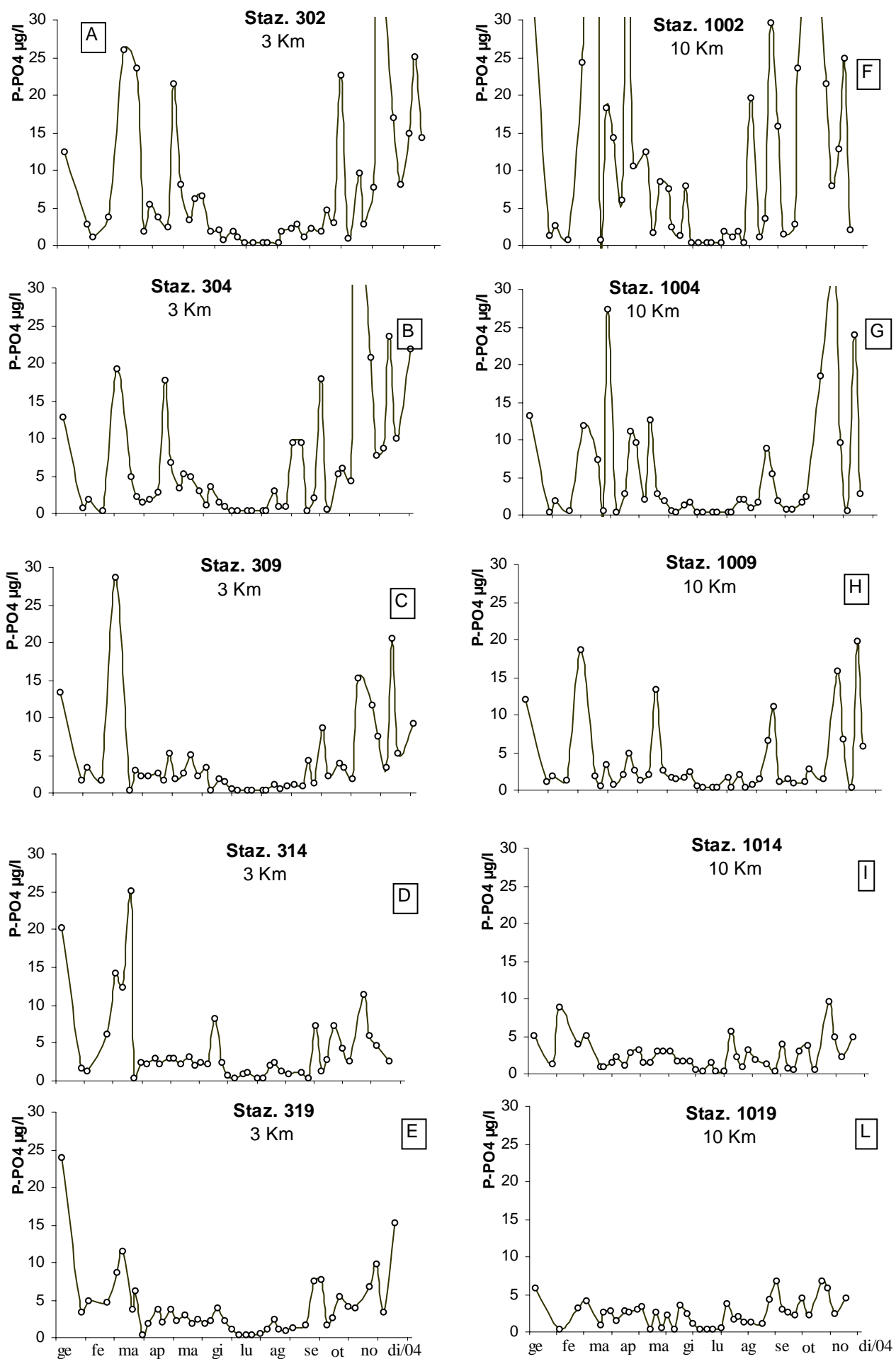


Fig 24 Andamenti temporali del Fosforo reattivo P-PO4 in superficie nelle stazioni a 3 e 10 Km dalla costa

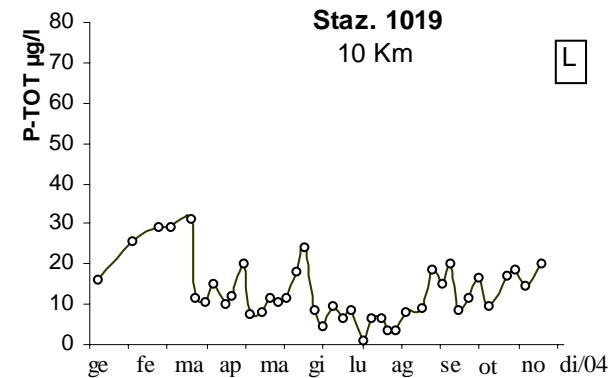
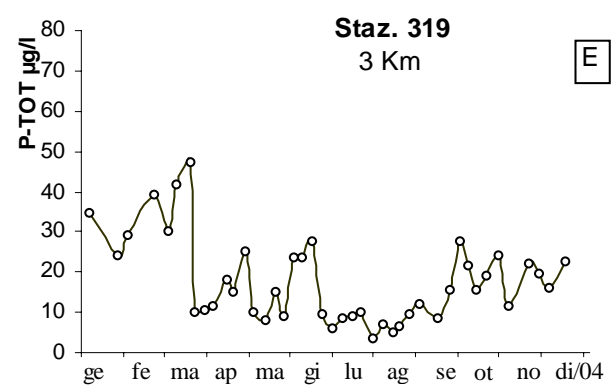
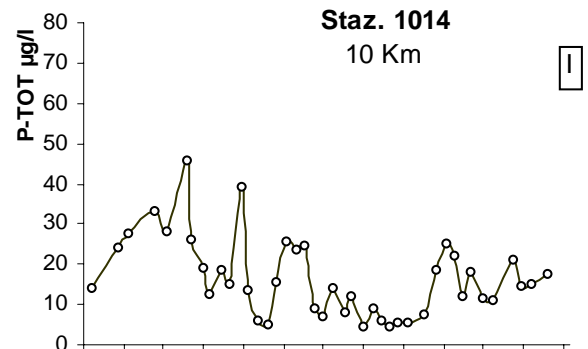
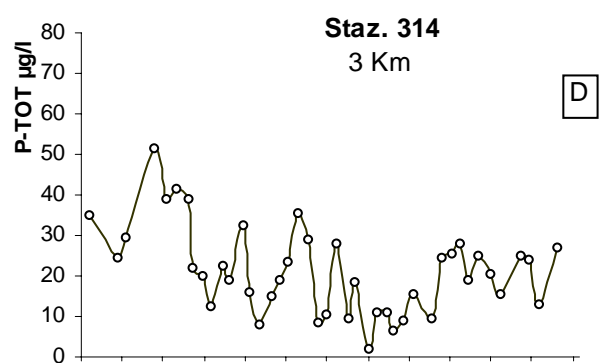
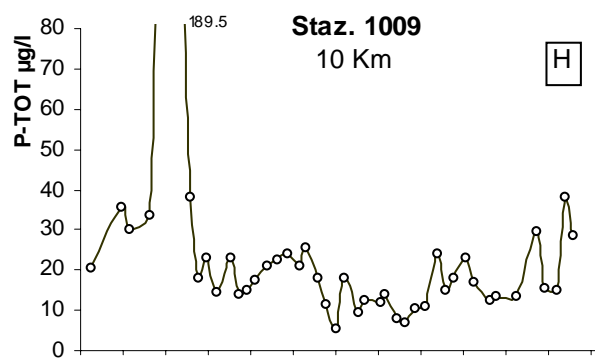
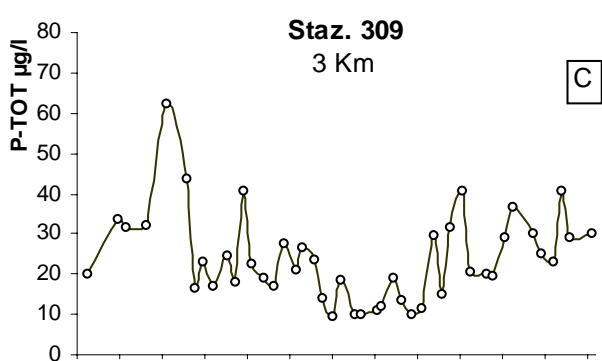
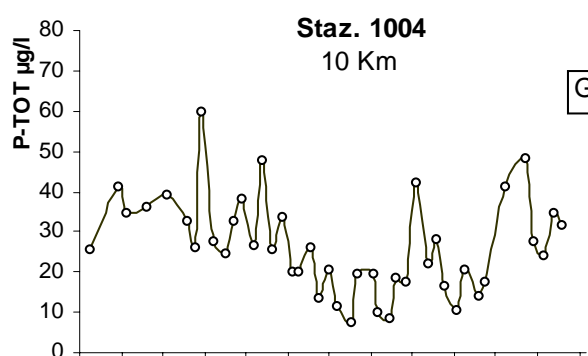
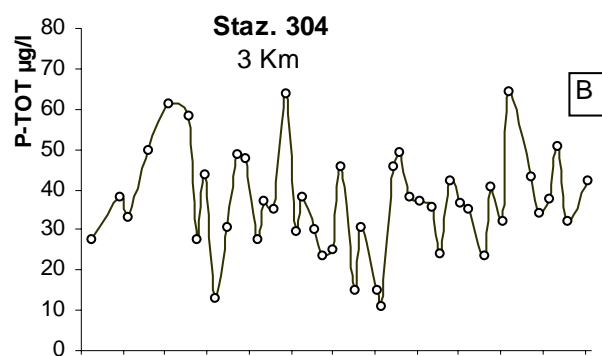
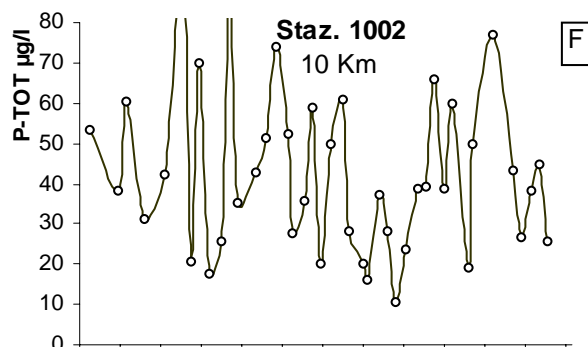
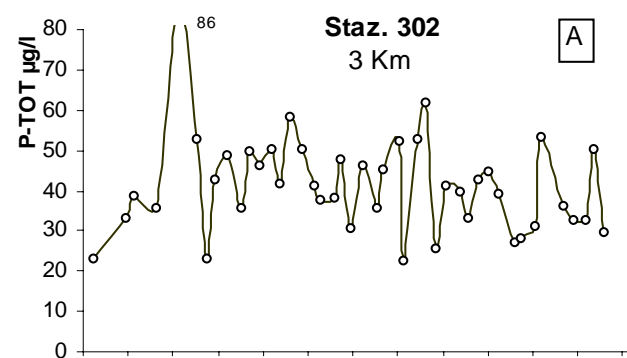


Fig 25 Andamenti temporali del Fosforo totale in superficie nelle stazioni a 3 e 10 Km dalla costa

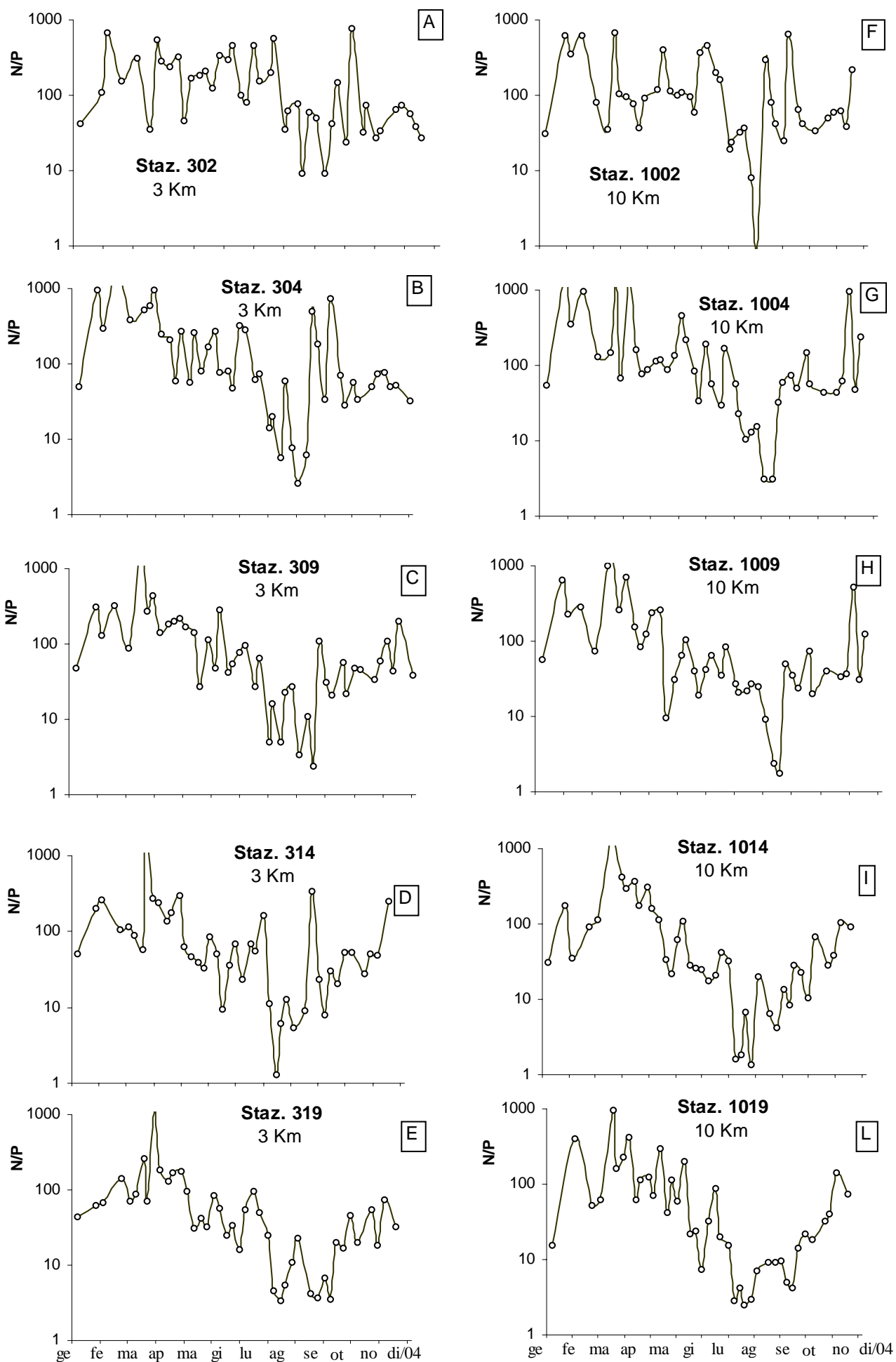


Fig 26 Andamenti temporali del rapporto Azoto/Fosforo in superficie nelle stazioni a 3 e 10 Km dalla costa

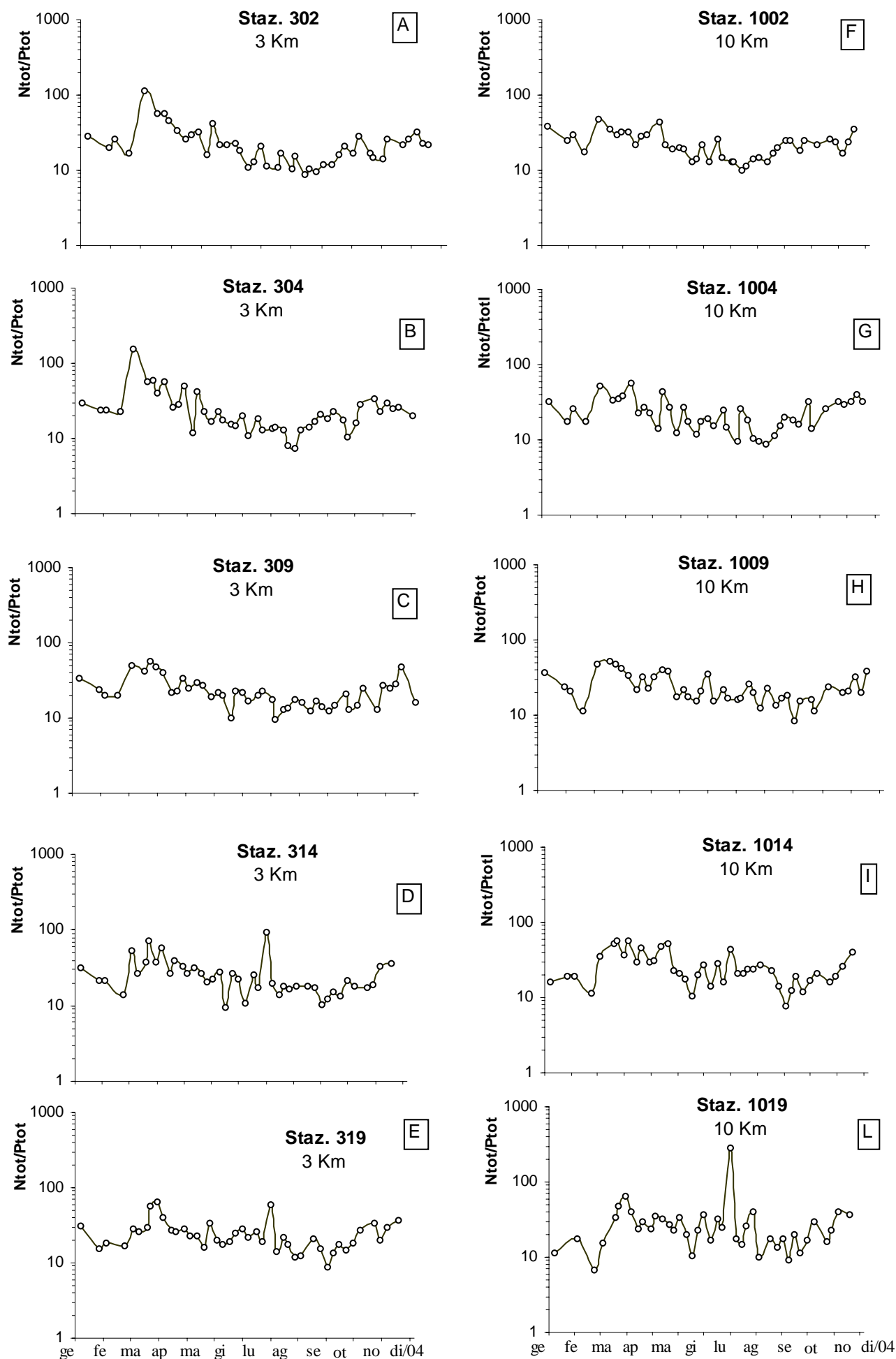


Fig 27 Andamenti temporali del rapporto Azoto totale/Fosforo totale in superficie nelle stazioni a 3 e 10 Km dalla costa

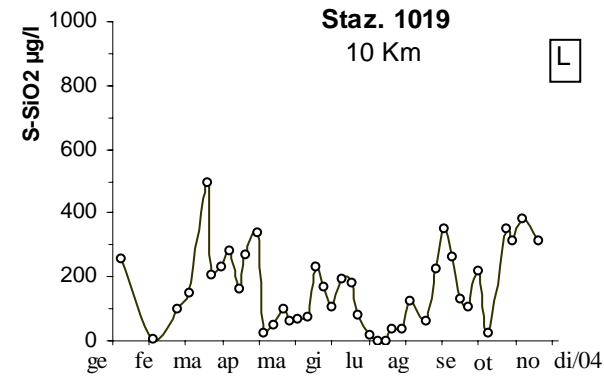
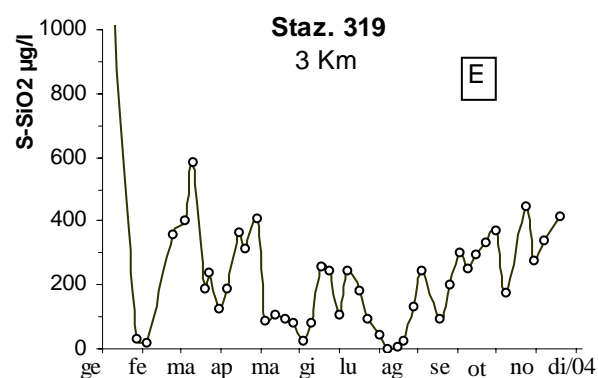
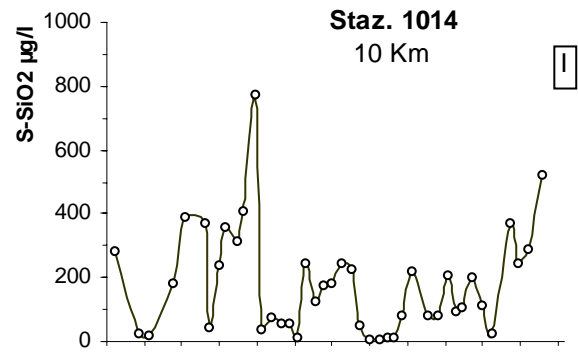
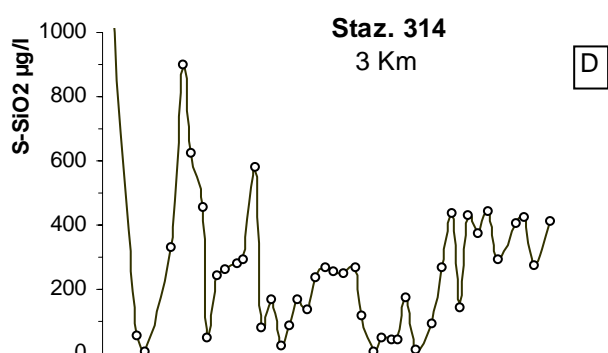
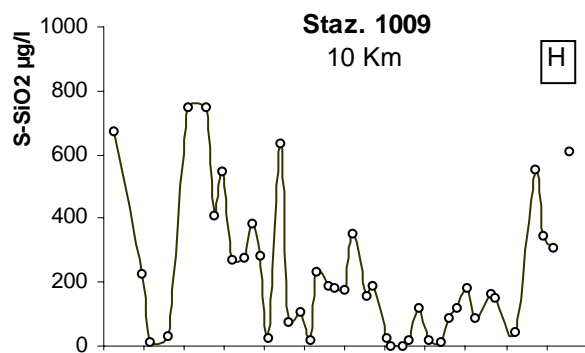
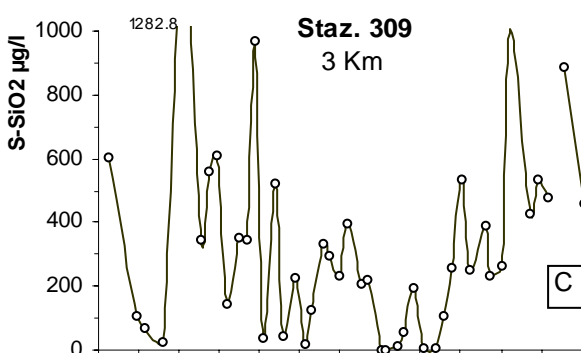
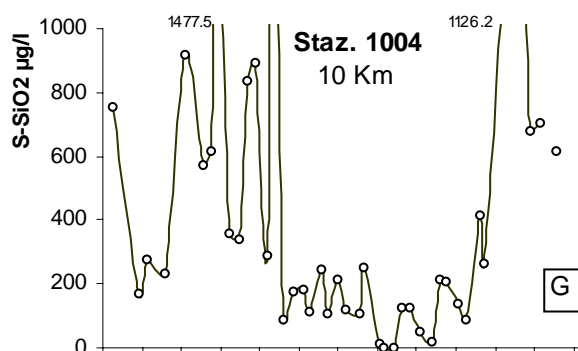
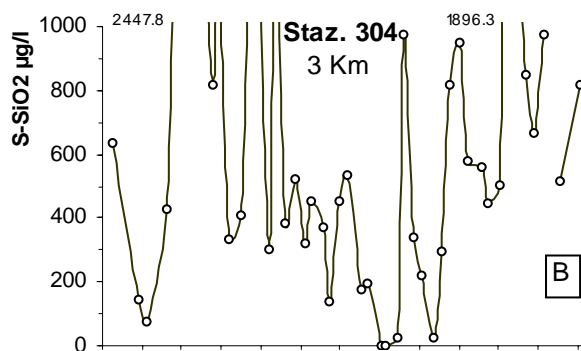
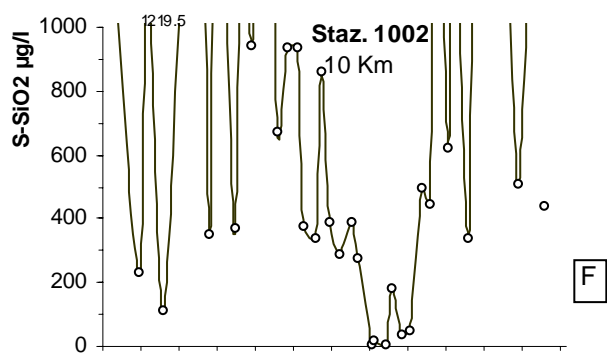
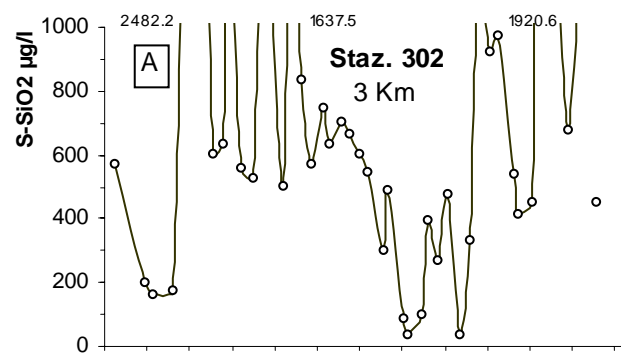


Fig 28 Andamenti temporali della Silice in superficie nelle stazioni a 3 e 10 Km dalla costa

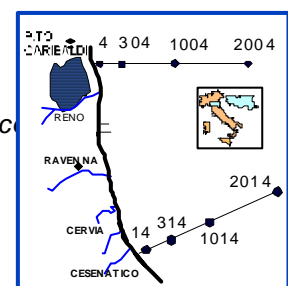
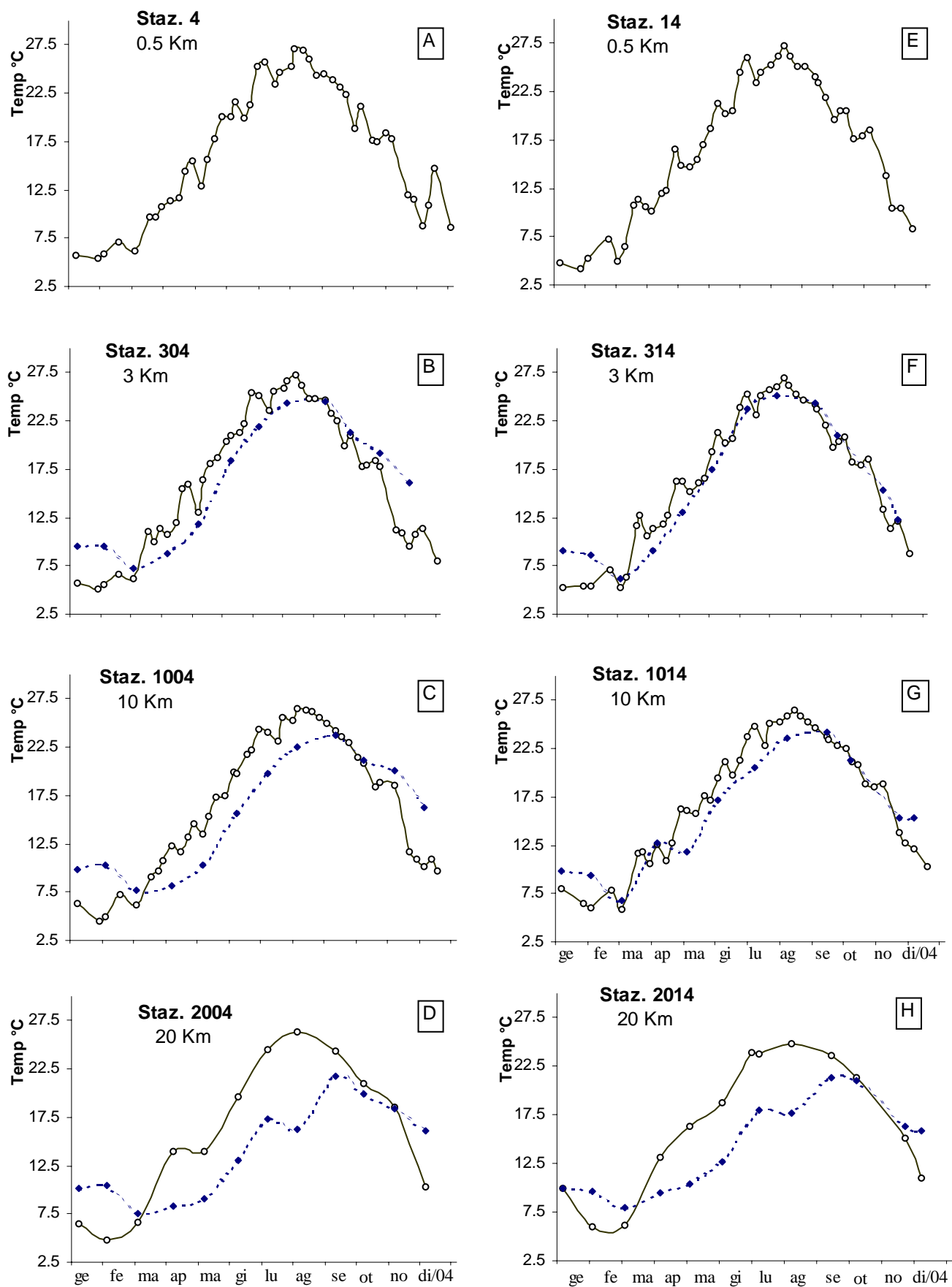


Fig. 29 Andamenti temporali della Temperatura in superficie (linea continua) e sul fondo (linea tratteggiata) nelle direttrici di P. Garibaldi e Cesenatico

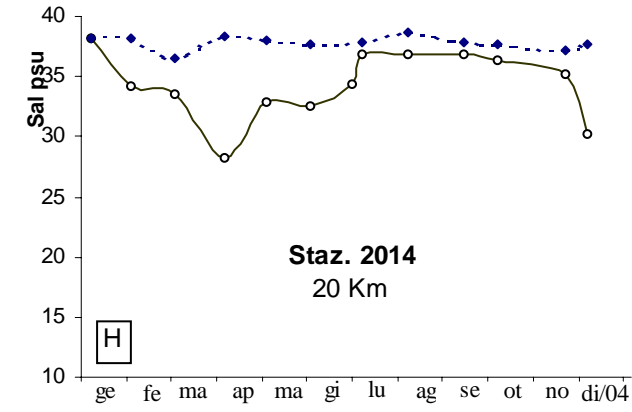
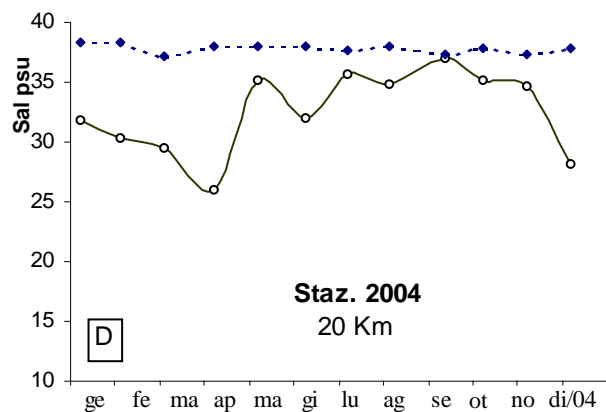
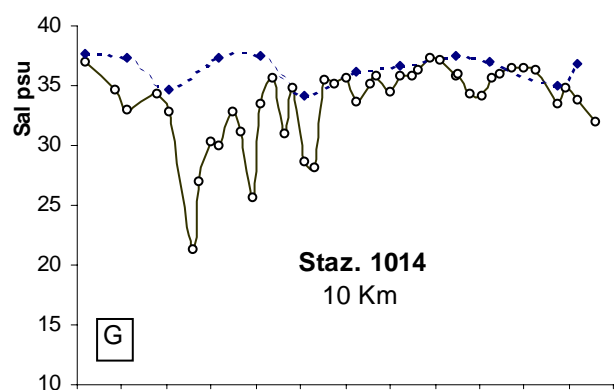
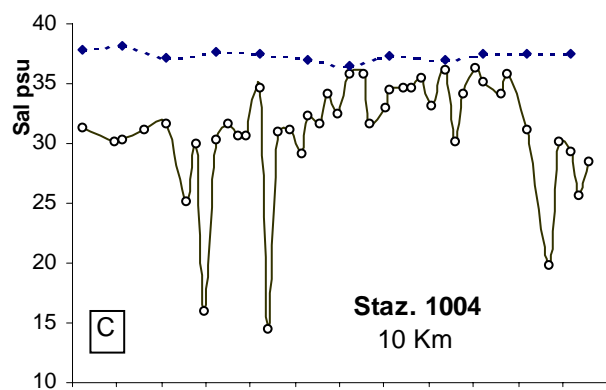
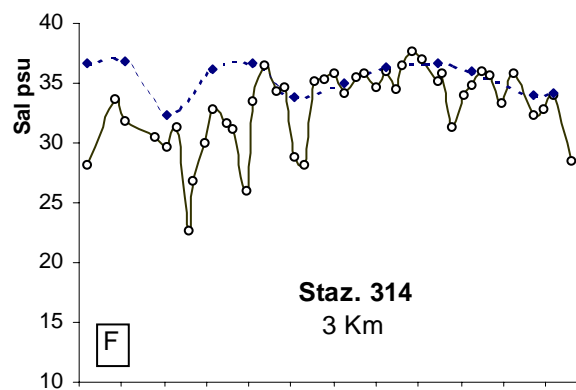
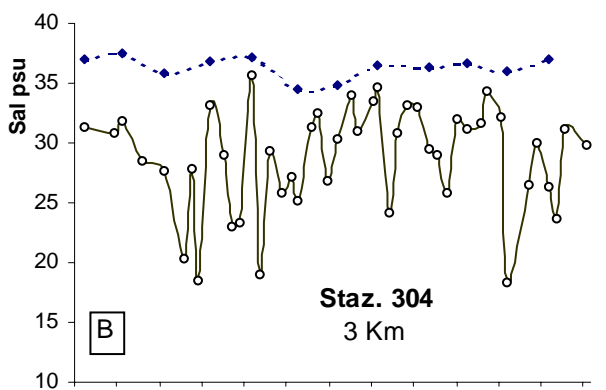
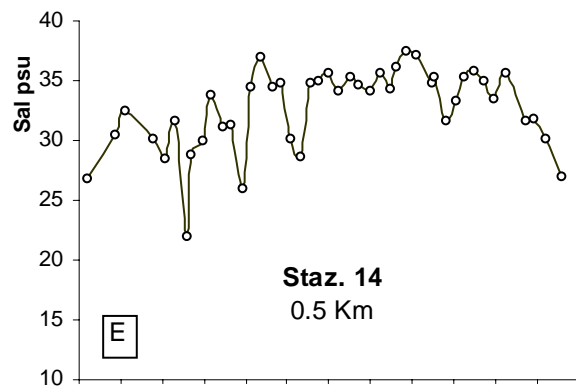
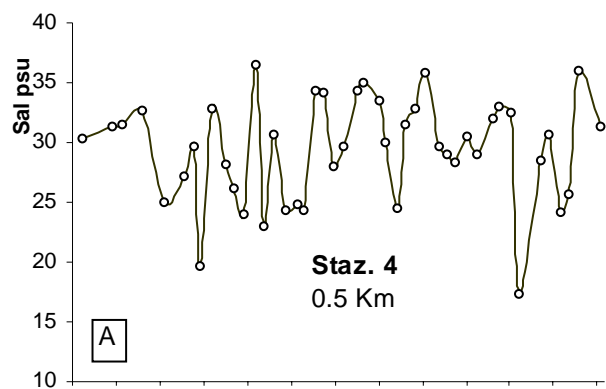
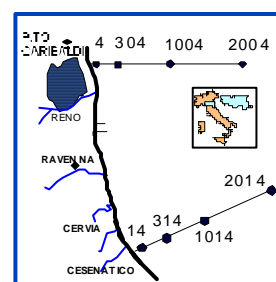


Fig 30 Andamenti temporali della Salinità in superficie (linea continua) e sul fondo (linea tratteggiata) nelle direttrici di P. Garibaldi e Cesenatico



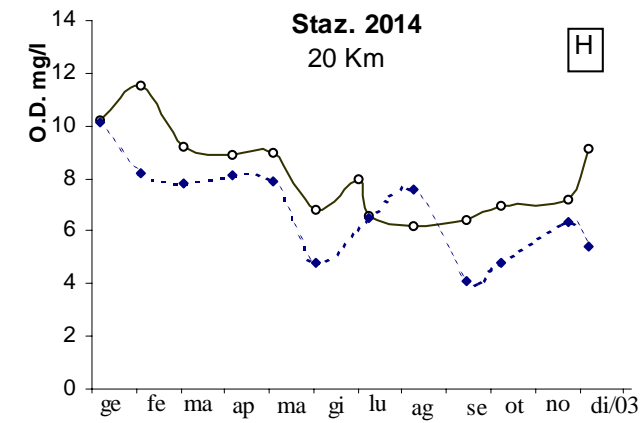
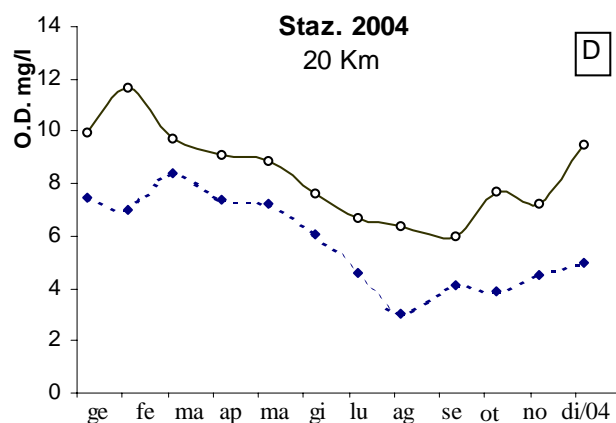
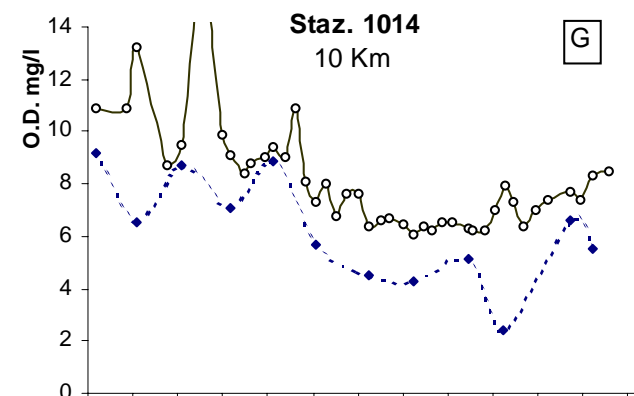
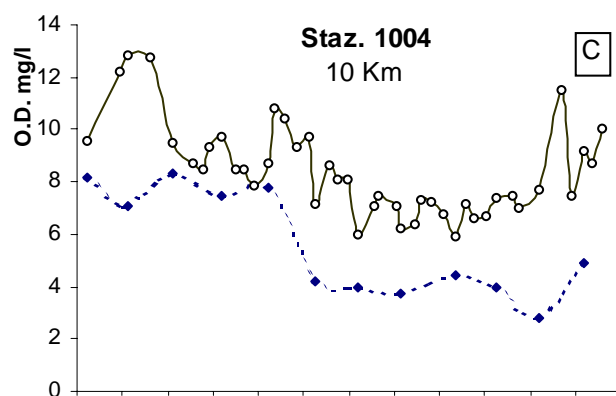
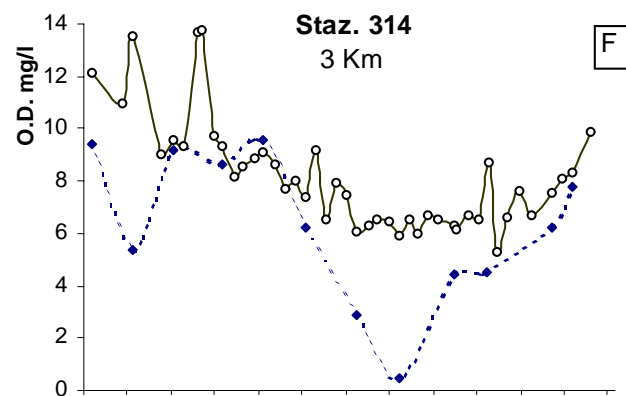
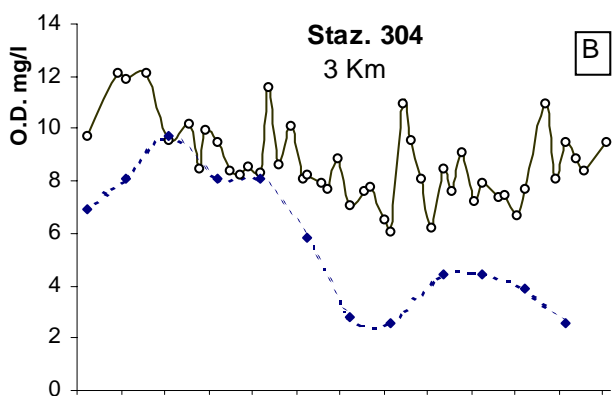
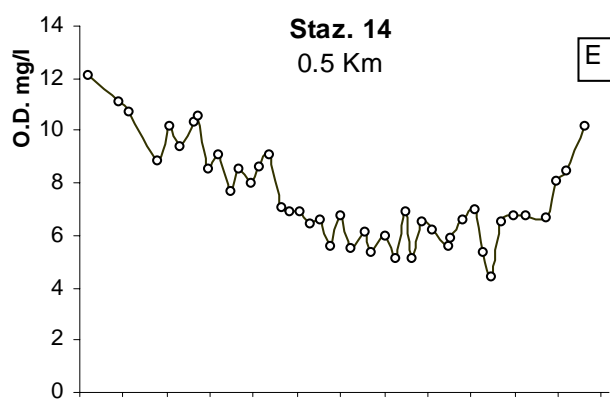
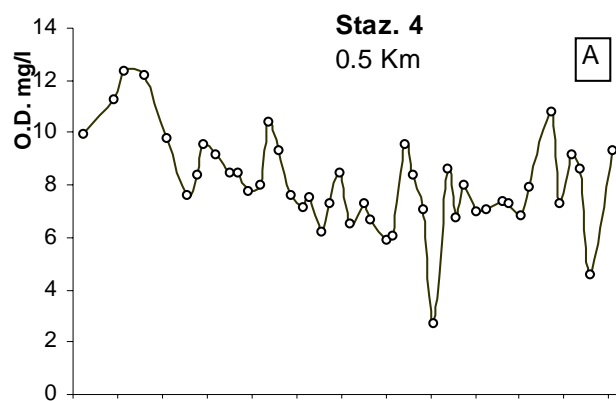
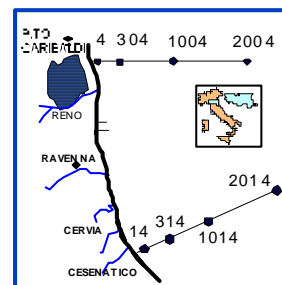


Fig 31 Andamenti temporali dell' Ossigeno in superficie (linea continua) e sul fondo (linea tratteggiata) nelle direttrici di P. Garibaldi e Cesenatico



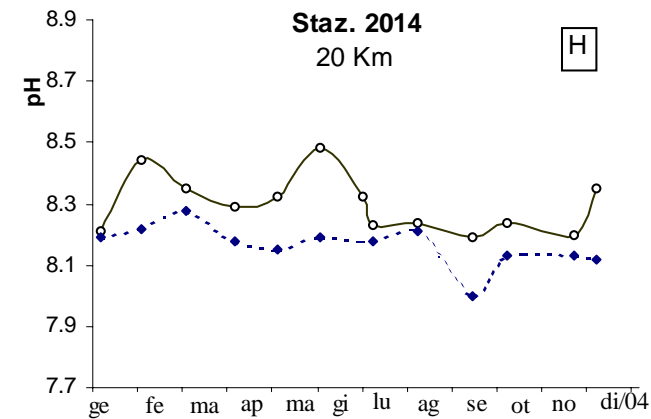
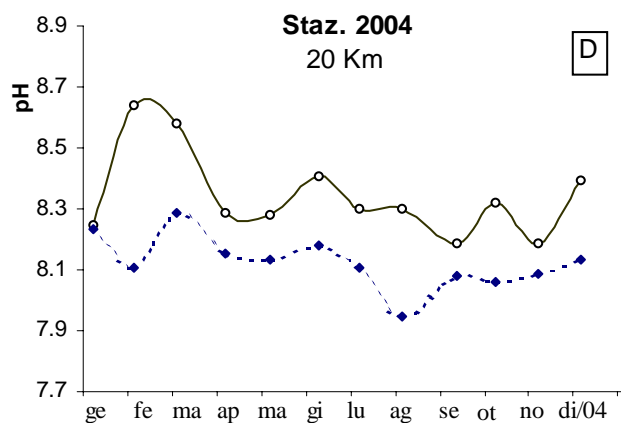
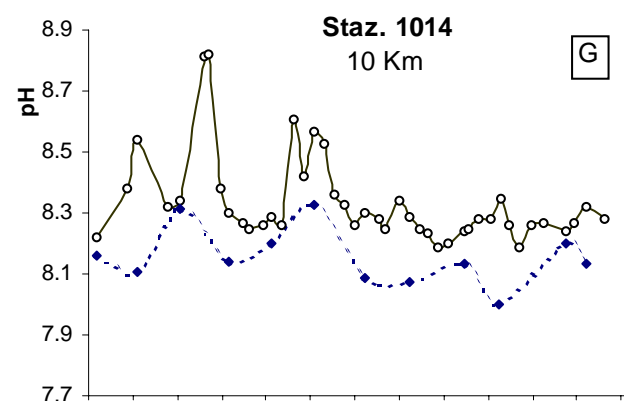
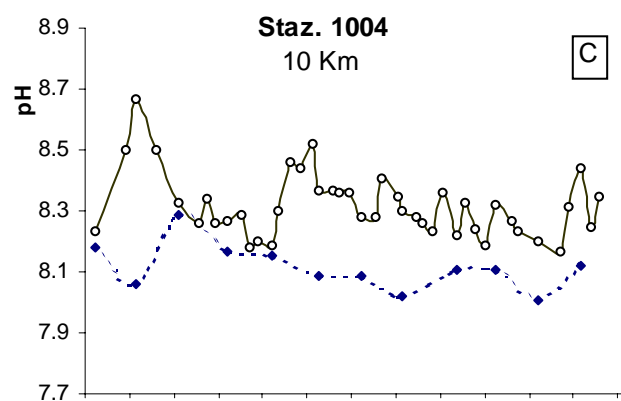
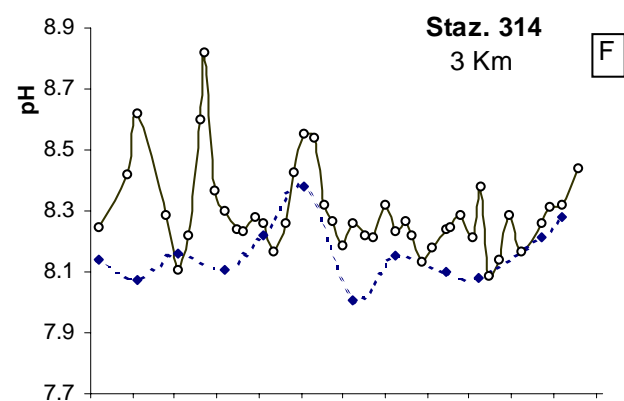
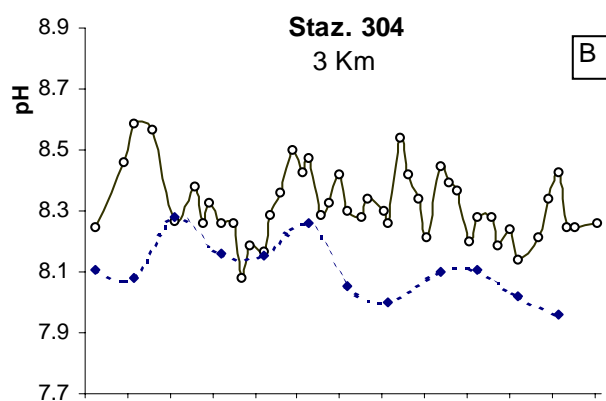
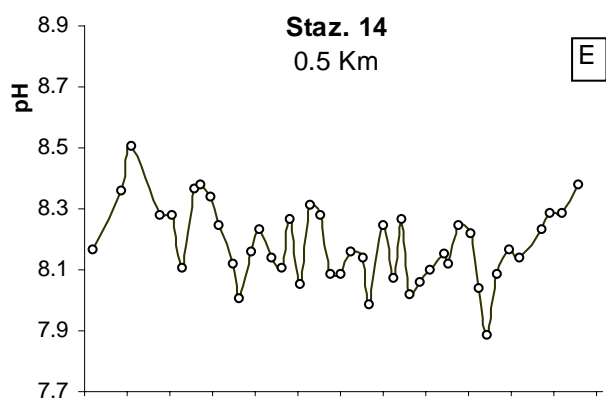
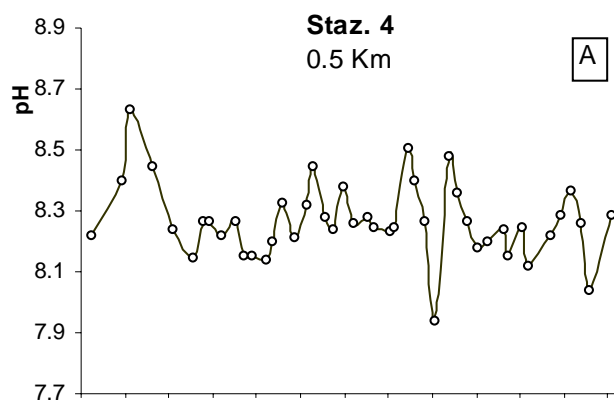
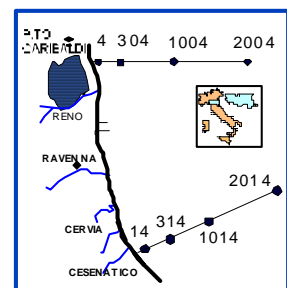


Fig 32 Andamenti temporali del pH in superficie (linea continua) e sul fondo (linea tratteggiata) nelle direttrici di P. Garibaldi e Cesenatico



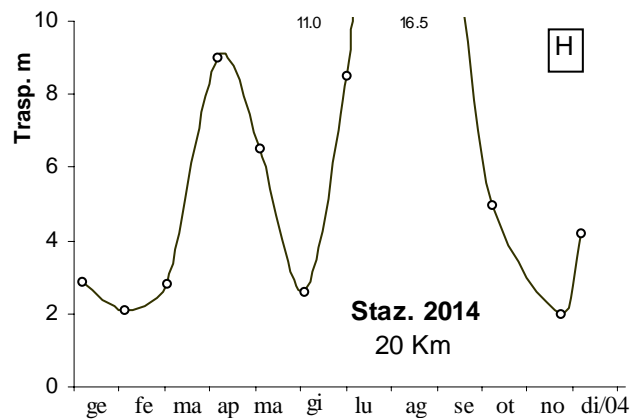
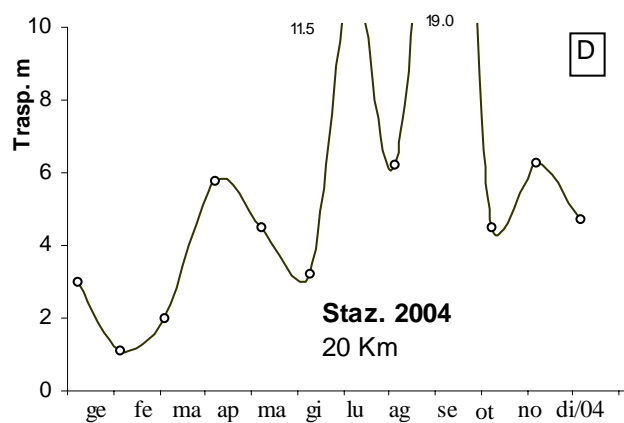
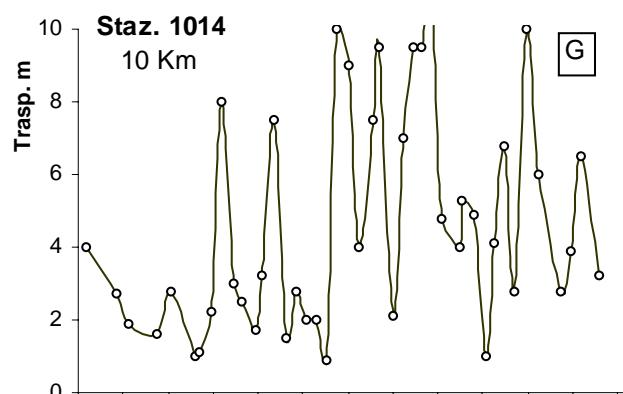
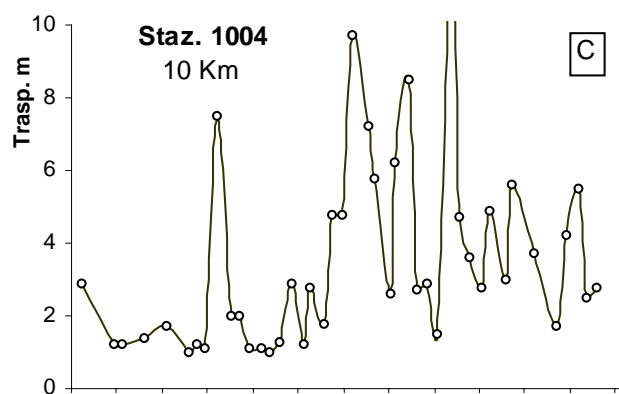
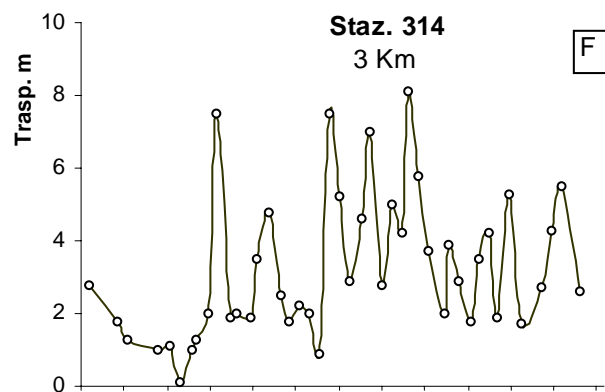
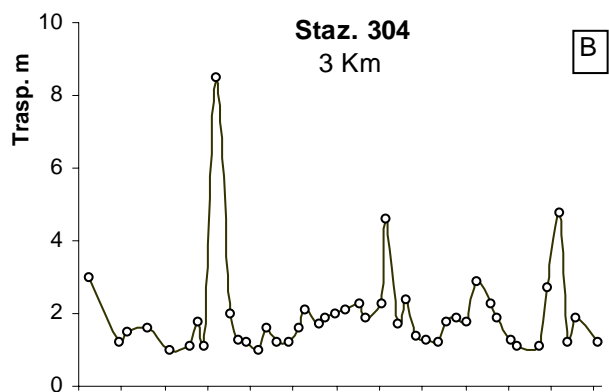
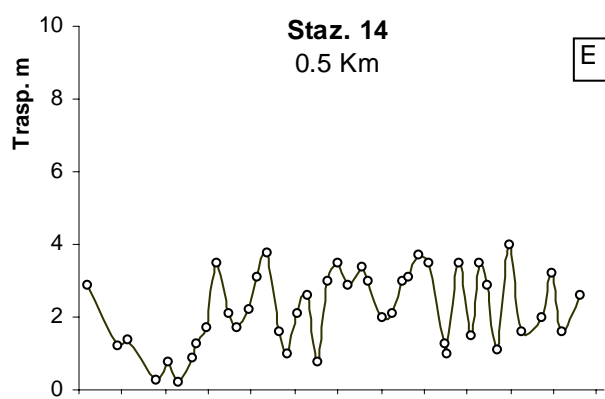
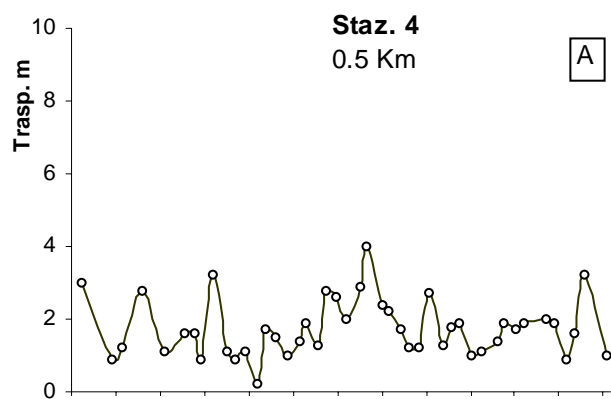
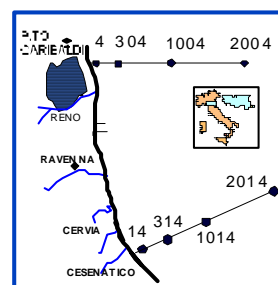


Fig 33 Andamenti temporali della trasparenza
nelle direttrici di P. Garibaldi e Cesenatico



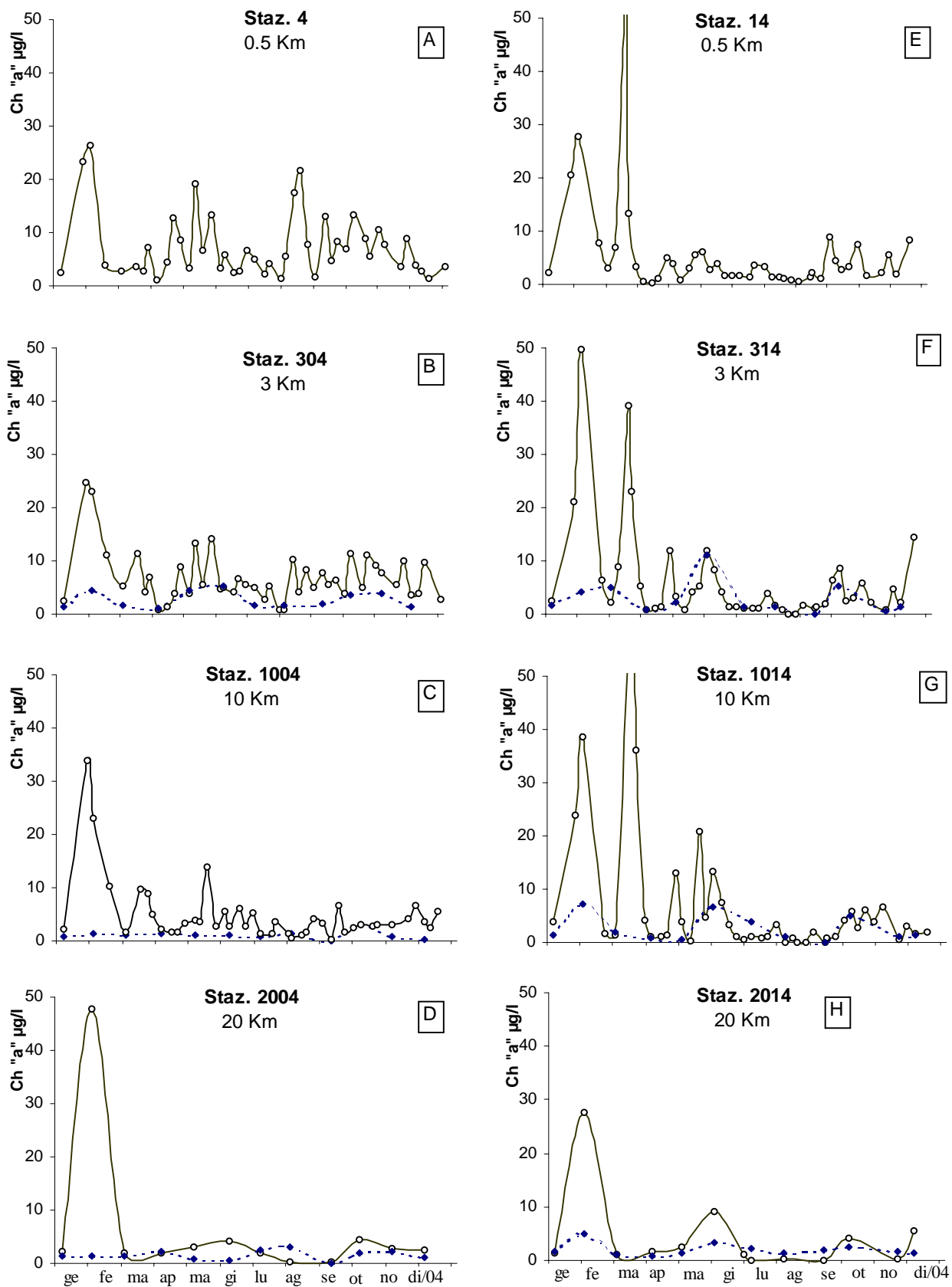
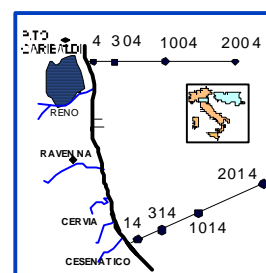


Fig 34 Andamenti temporali della Clorofilla "a" in superficie (linea continua) e sul fondo (linea tratteggiata) nelle direttrici di P. Garibaldi e Cesenatico



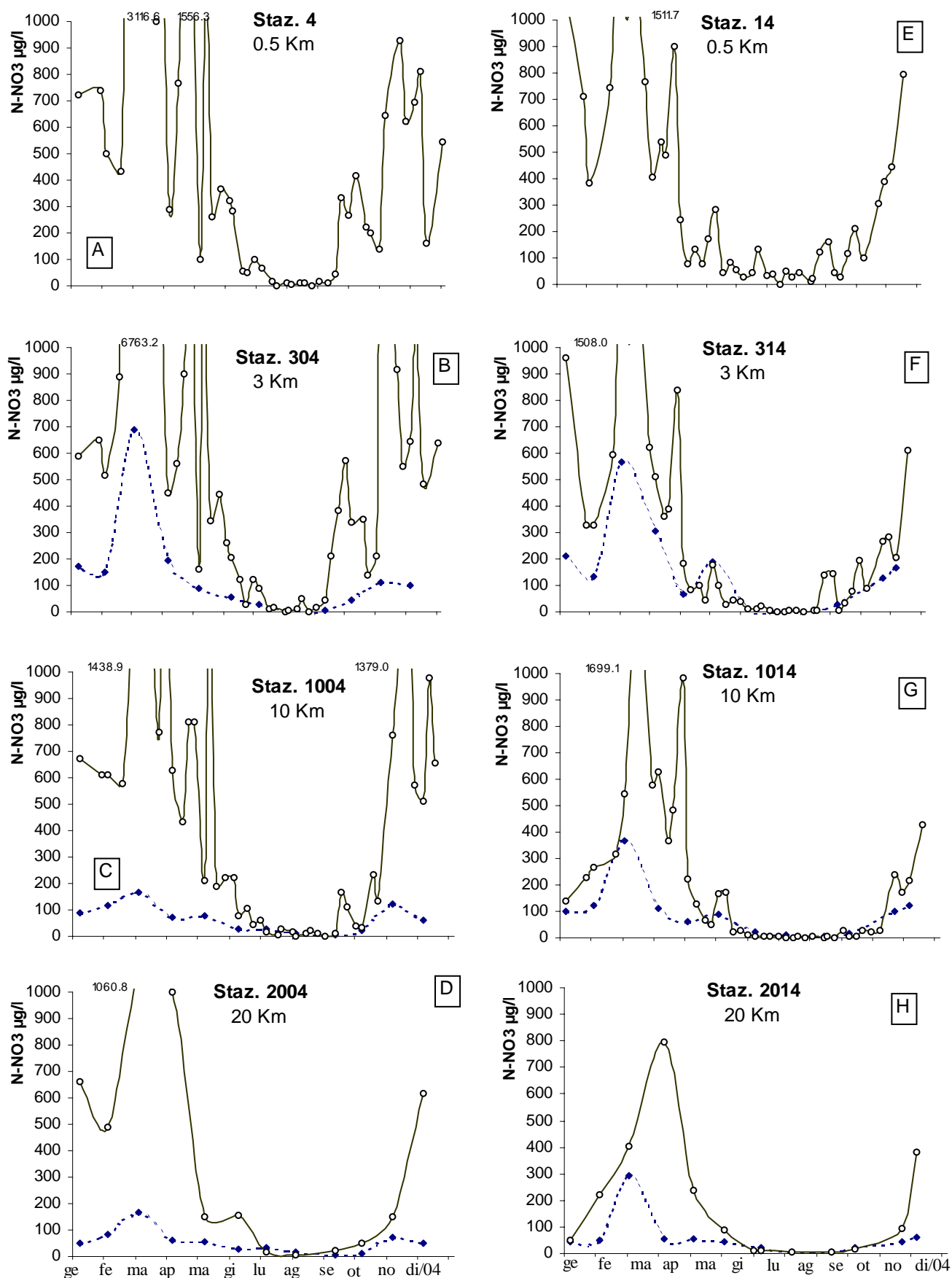
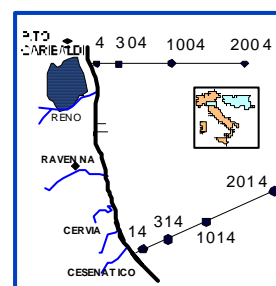


Fig 35 Andamenti temporali del Nitrato N-NO₃ in superficie (linea continua) e sul fondo (linea tratteggiata) nelle direttrici di P. Garibaldi e Cesenatico



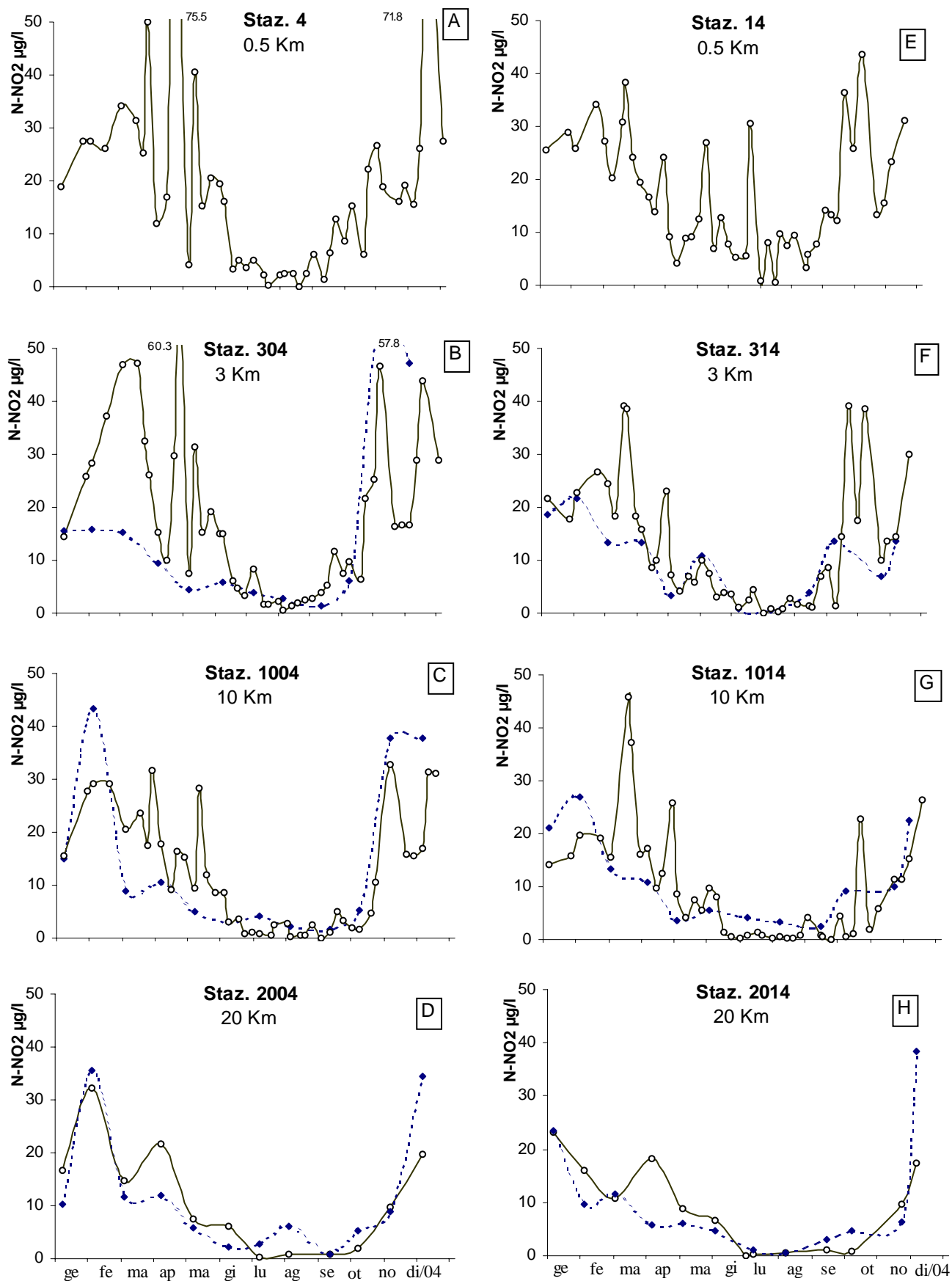
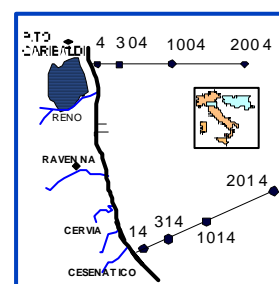


Fig 36 Andamenti temporali del Nitrito N-NO₂ in superficie (linea continua) e sul fondo (linea tratteggiata) nelle direttrici di P. Garibaldi e Cesenatico



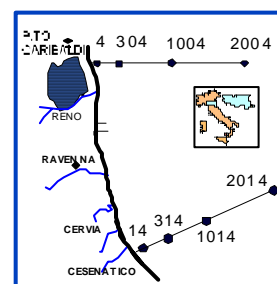
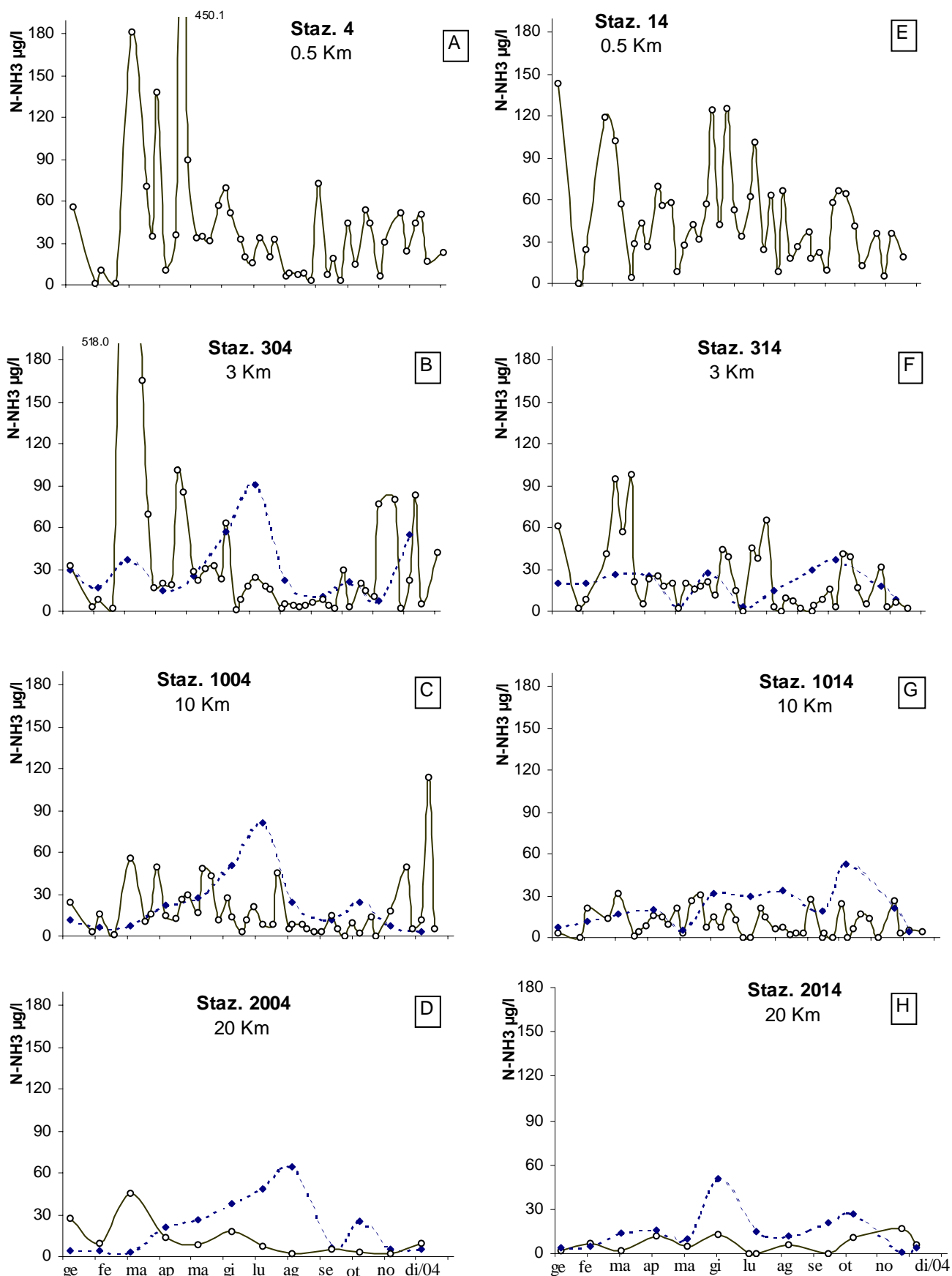


Fig 37 Andamenti temporali dell' Azoto ammoniacale $N-NH_3$ in superficie (linea continua) e sul fondo (linea tratteggiata) nelle direttrici di P. Garibaldi e Cesenatico

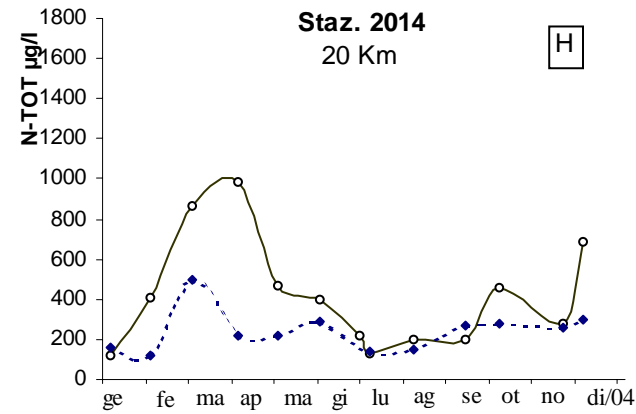
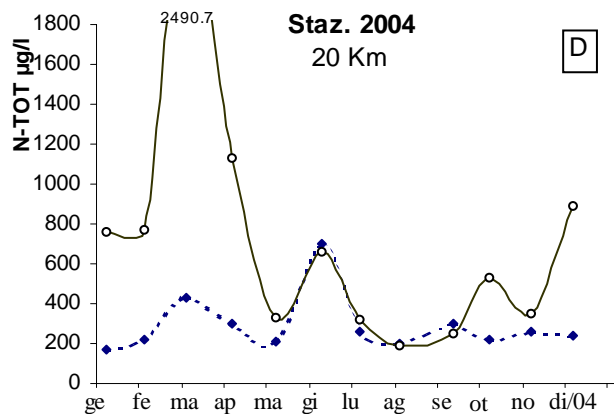
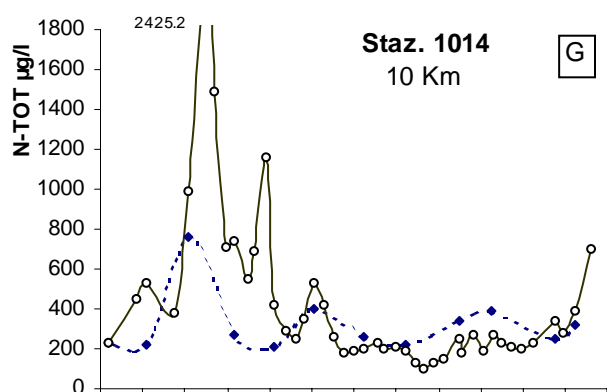
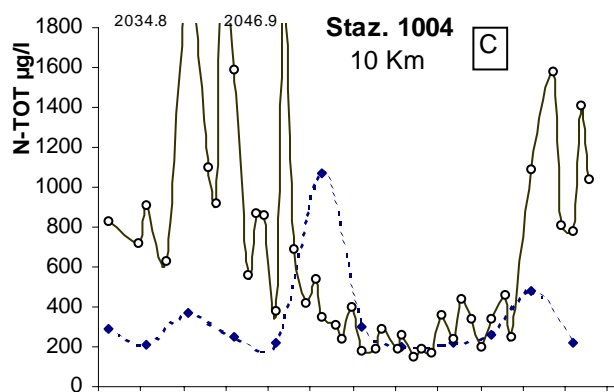
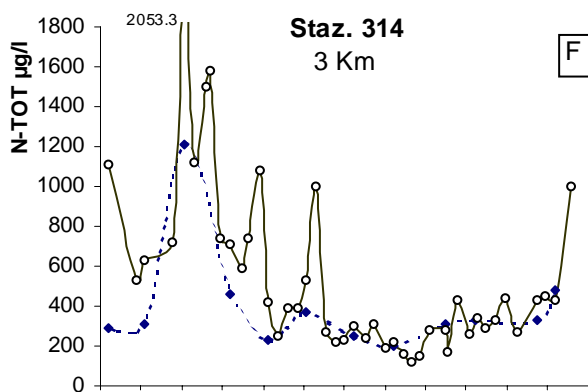
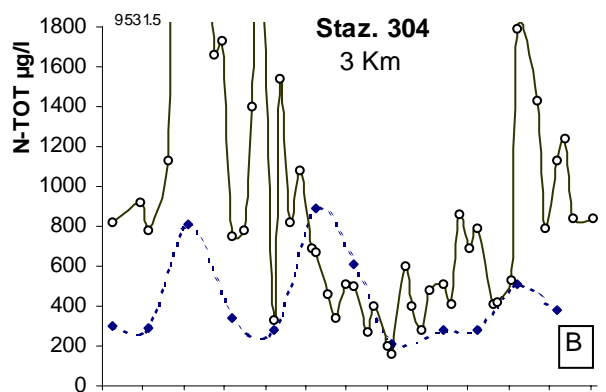
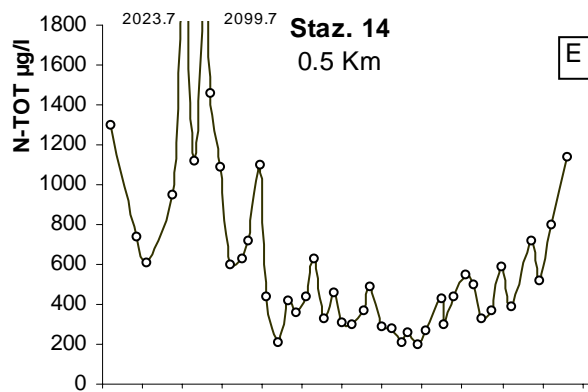
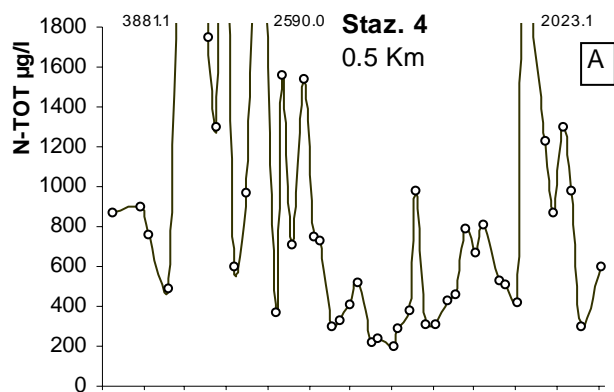
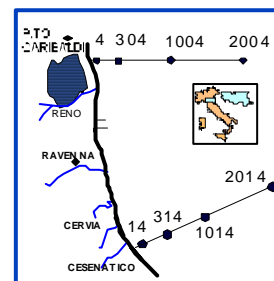


Fig 38 Andamenti temporali dell' Azoto totale in superficie (linea continua) e sul fondo (linea tratteggiata) nelle direttrici di P. Garibaldi e Cesenatico



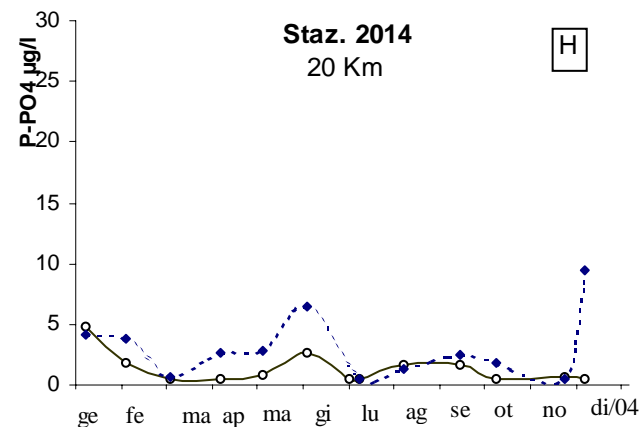
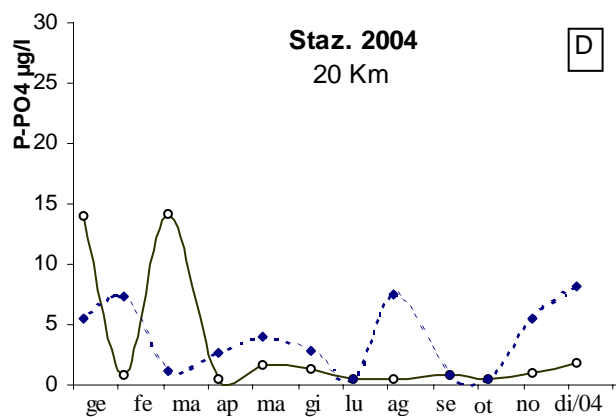
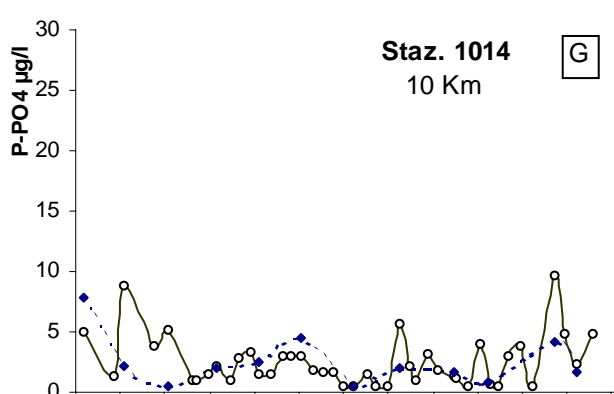
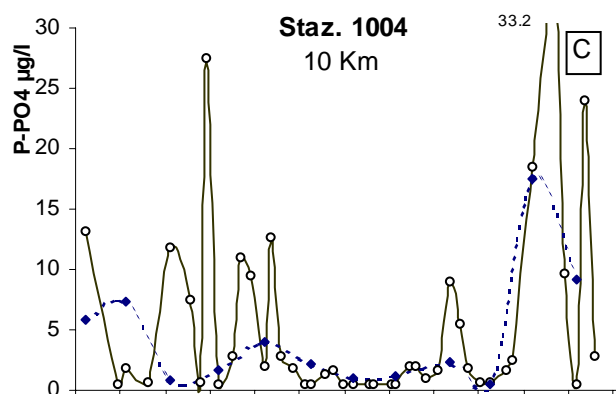
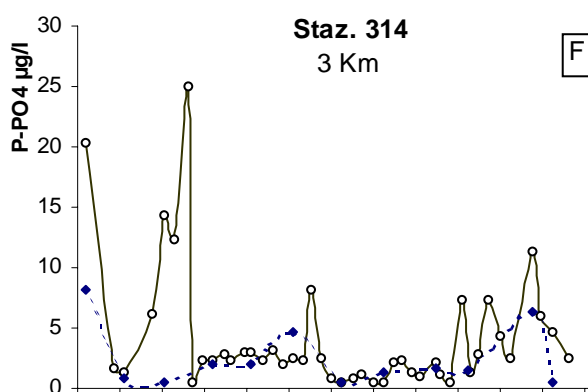
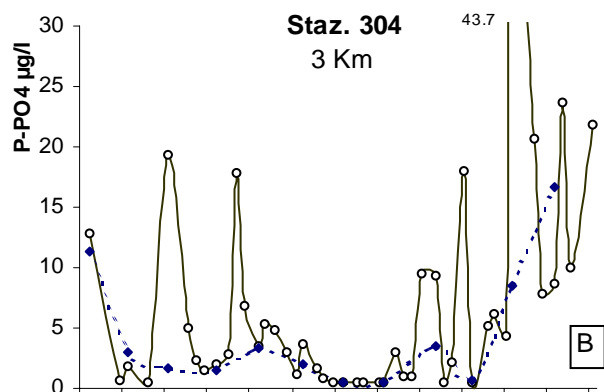
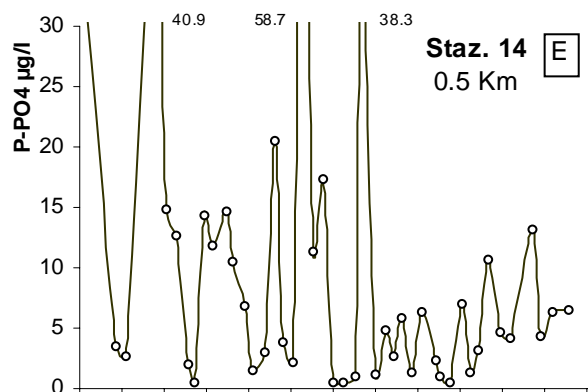
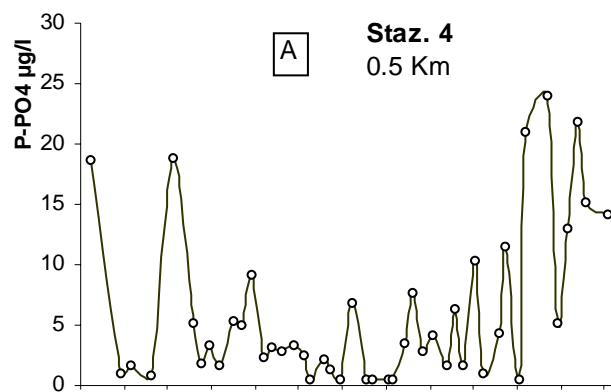
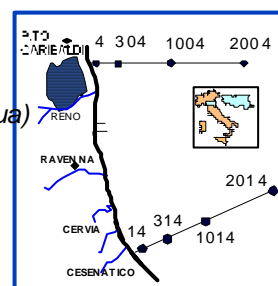


Fig 39 Andamenti temporali del Fosforo reattivo P-PO₄ in superficie (linea continua) e sul fondo (linea tratteggiata) nelle direttrici di P. Garibaldi e Cesenatico



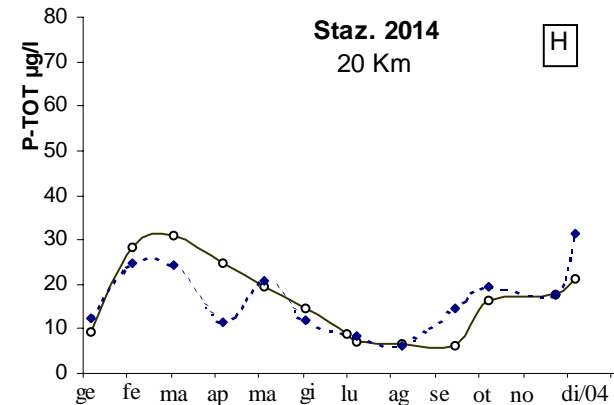
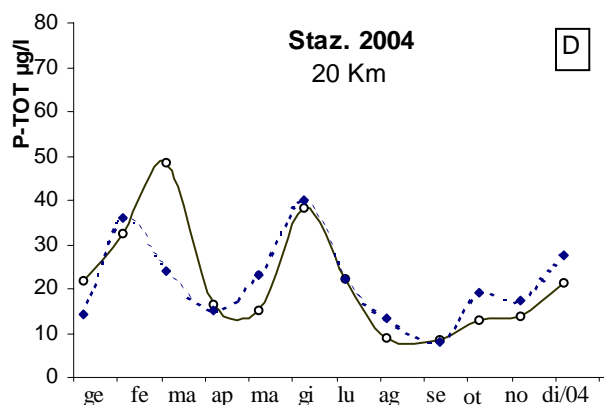
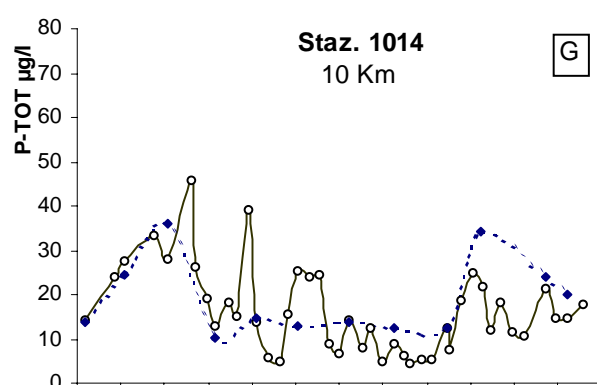
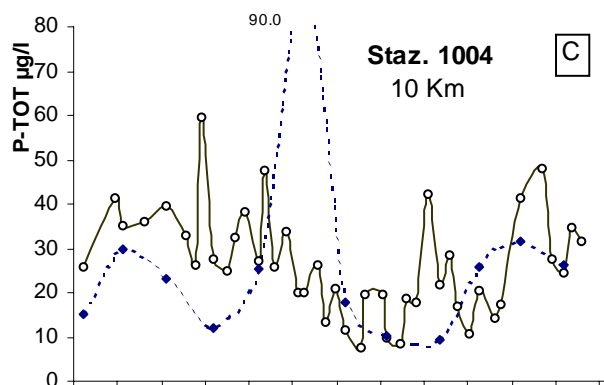
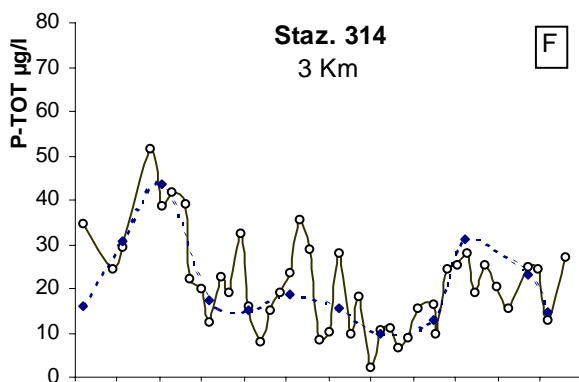
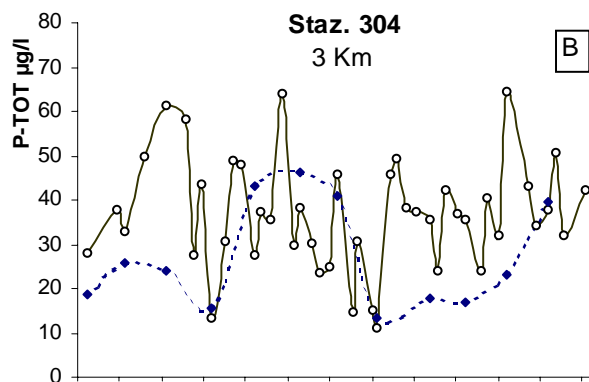
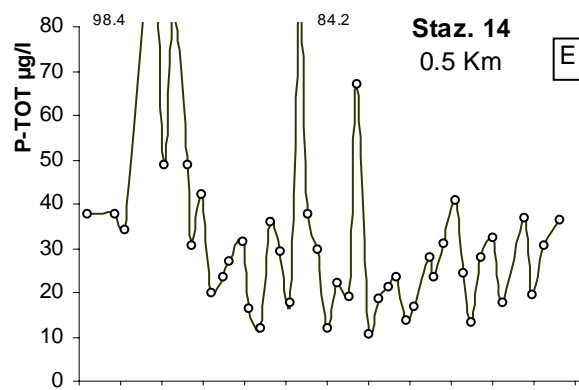
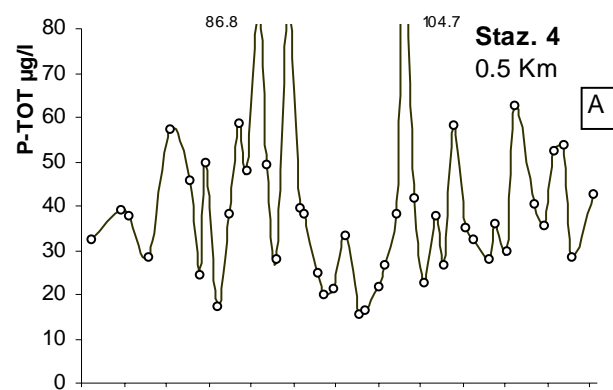
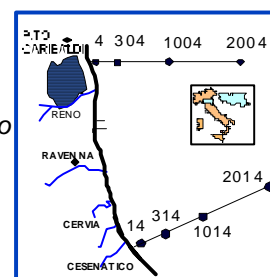


Fig. 40 Andamenti temporali del Fosforo totale in superficie (linea continua) e sul fondo (linea tratteggiata) nelle direttrici di P. Garibaldi e Cesenatico



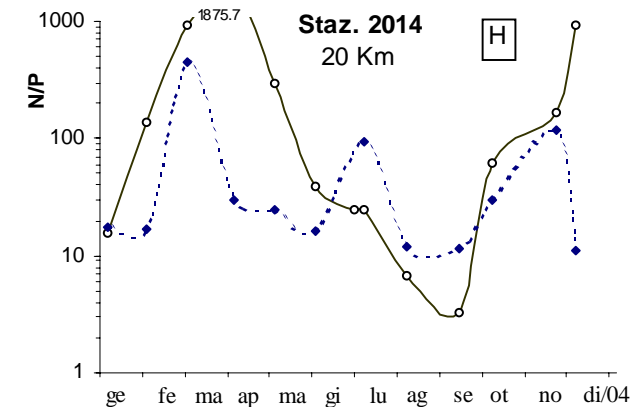
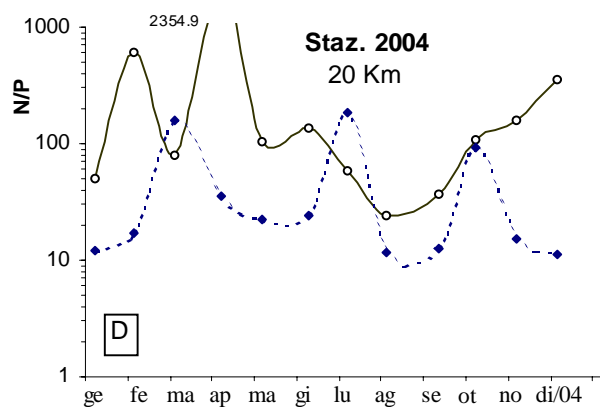
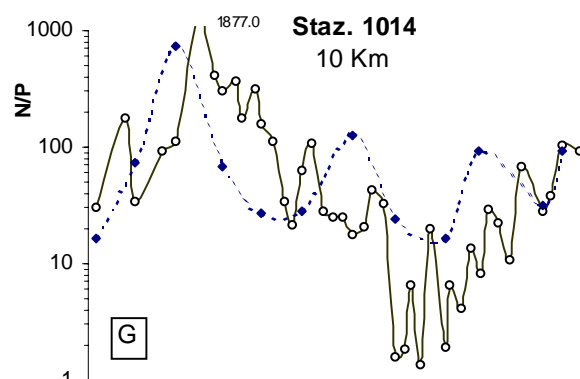
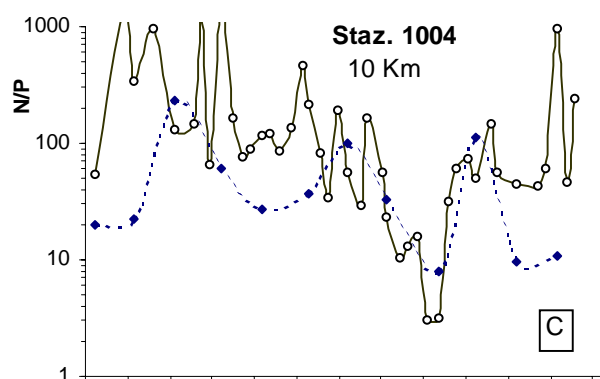
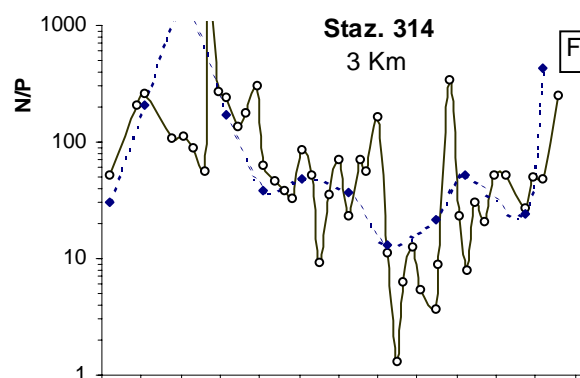
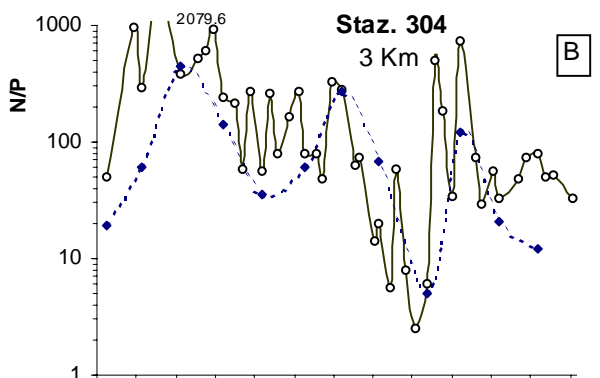
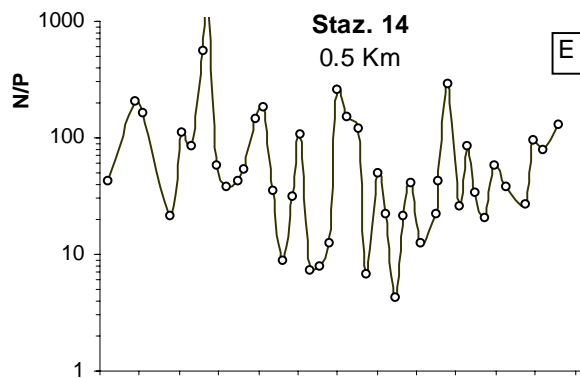
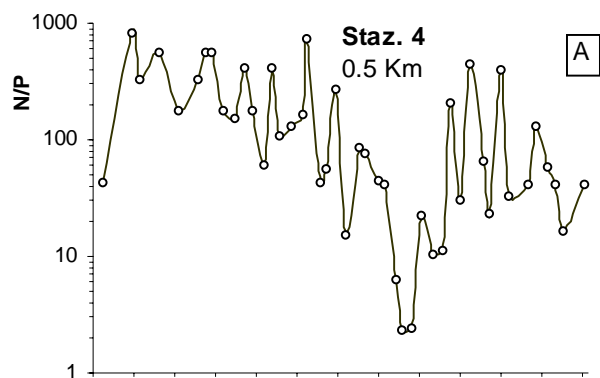
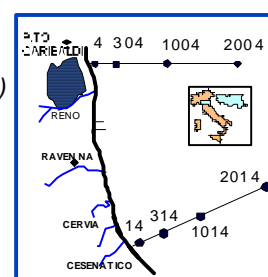


Fig 41 Andamenti temporali del rapporto Azoto/Fosforo in superficie (linea continua) e sul fondo (linea tratteggiata) nelle direttrici di P. Garibaldi e Cesenatico



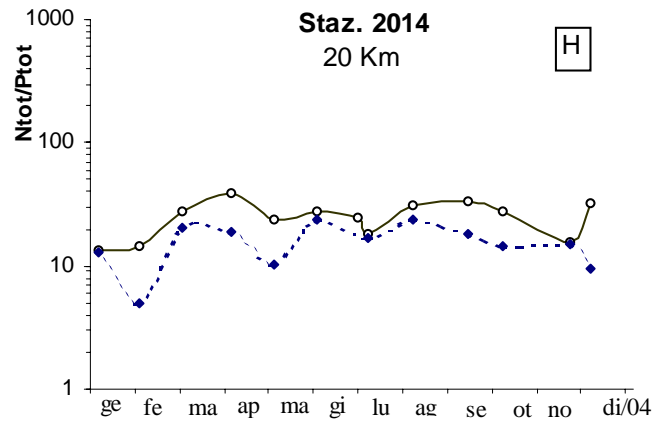
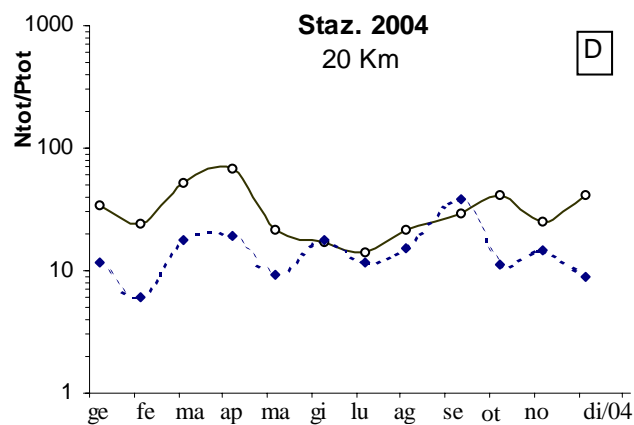
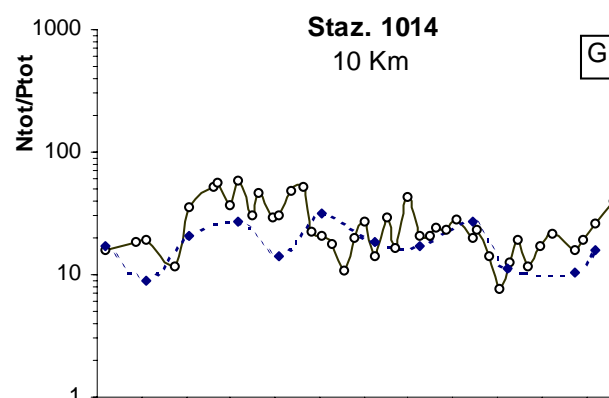
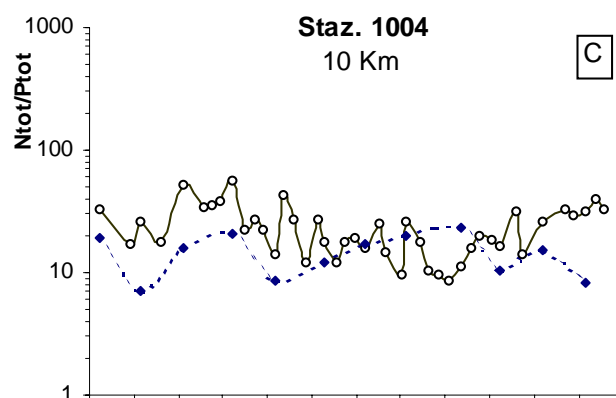
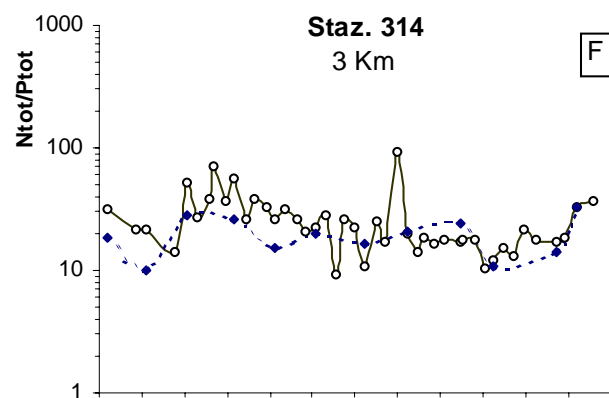
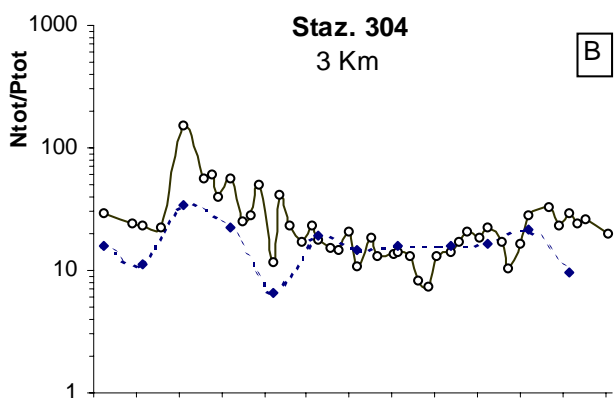
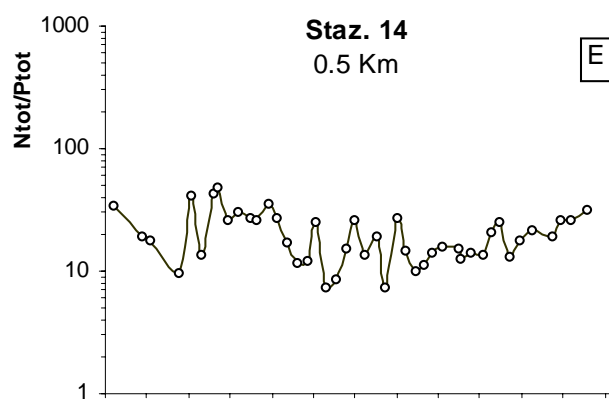
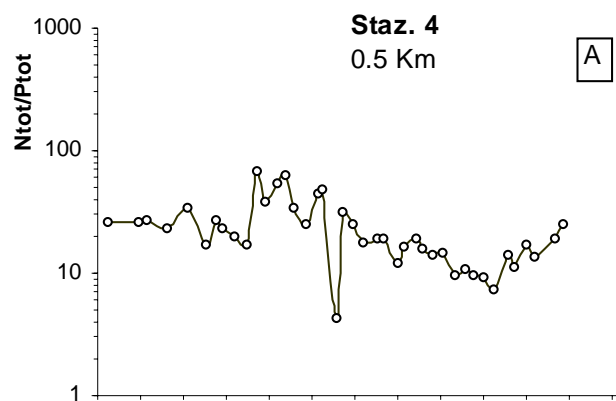
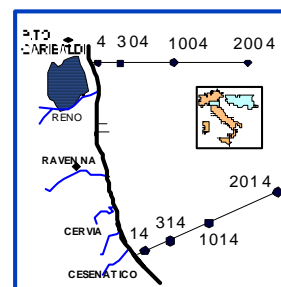


Fig 42 Andamenti temporali del rapporto Azoto totale/Fosforo totale in superficie (linea continua) e sul fondo (linea tratteggiata) nelle direttrici di P. Garibaldi e Cesenatico



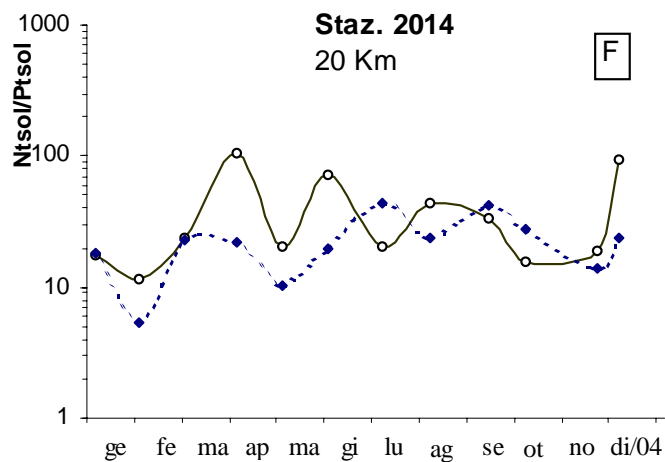
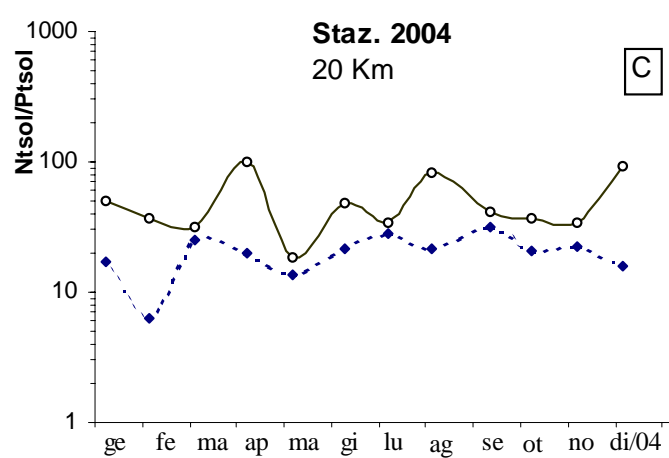
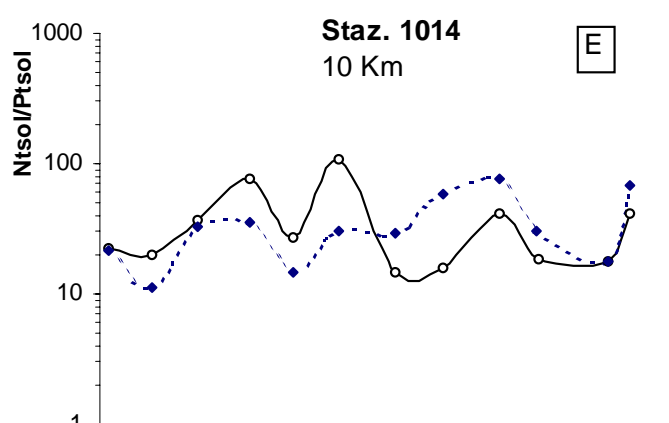
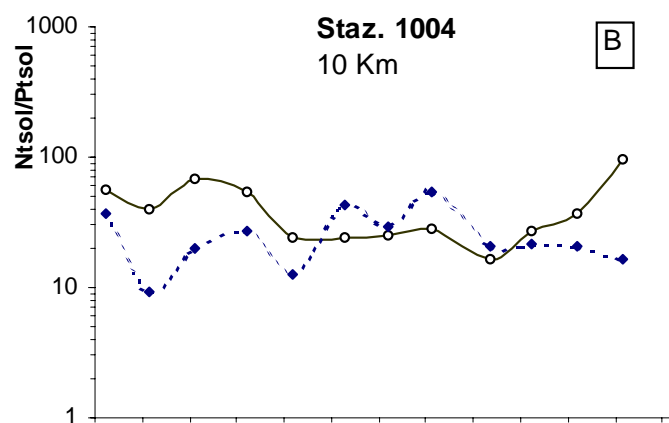
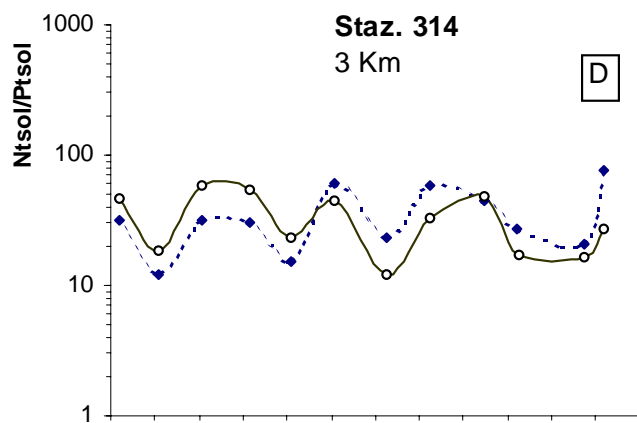
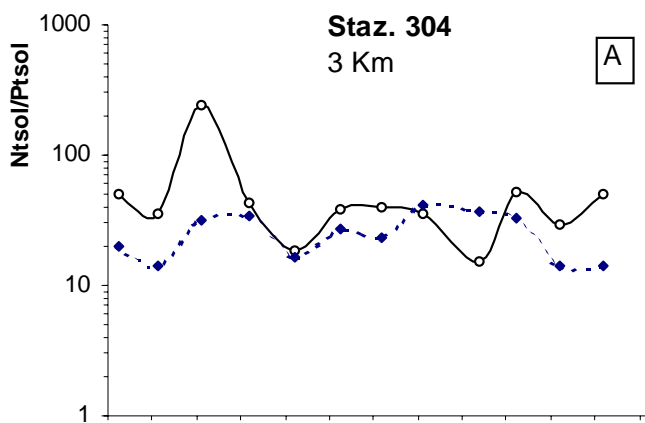
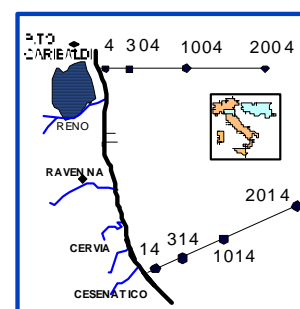


Fig 43 Andamenti temporali del rapporto Azoto totale solubile/Fosforo totale solubile in superficie (linea continua) e sul fondo (linea tratteggiata) nelle direttrici di P. Garibaldi e Cesenatico



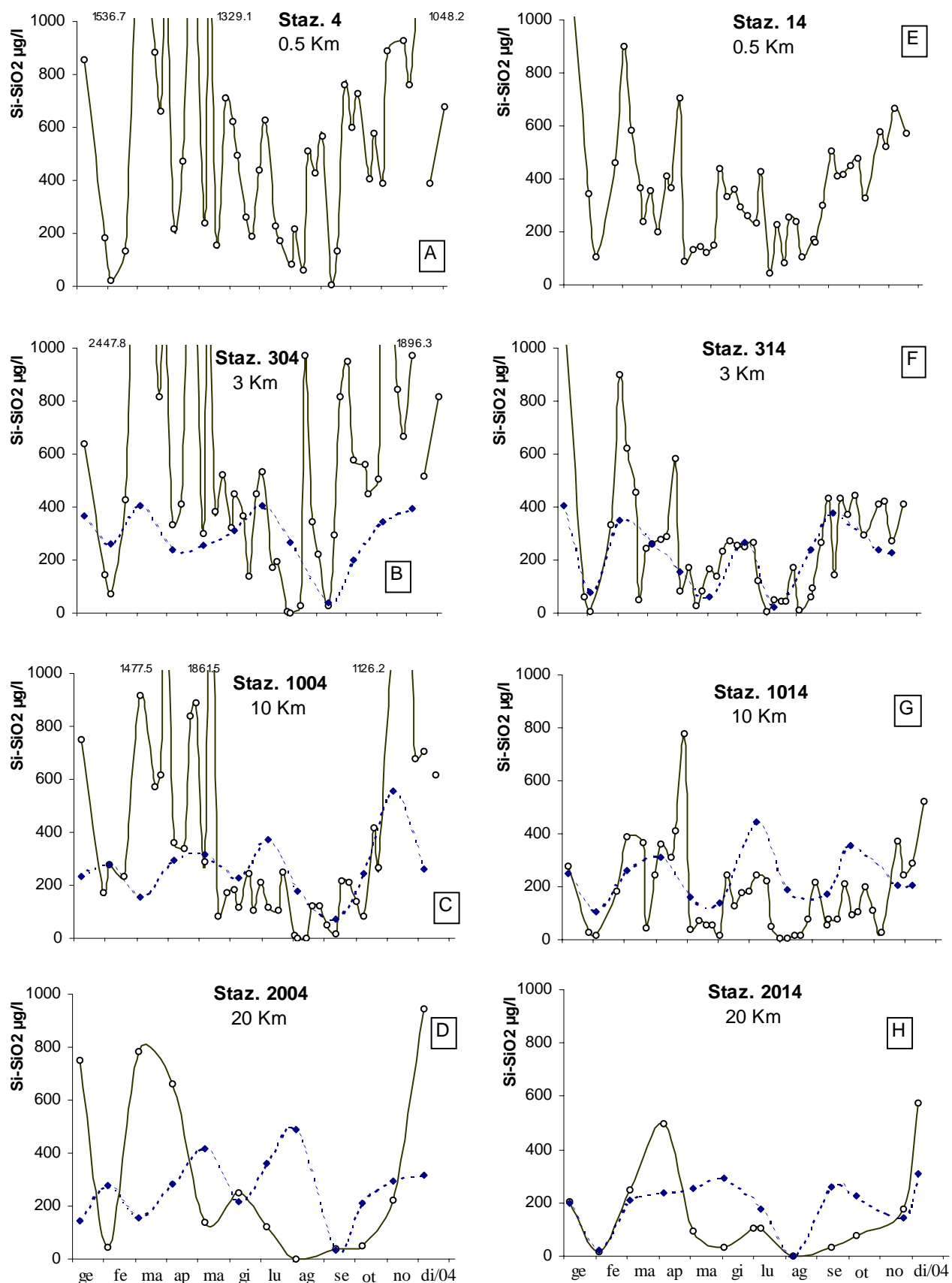
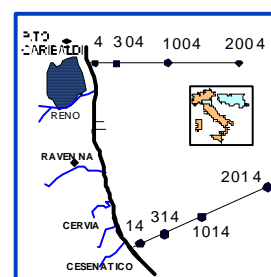


Fig 44 Andamenti temporali della Silice in superficie (linea continua) e sul fondo (linea tratteggiata) nelle direttrici di P. Garibaldi e Cesenatico



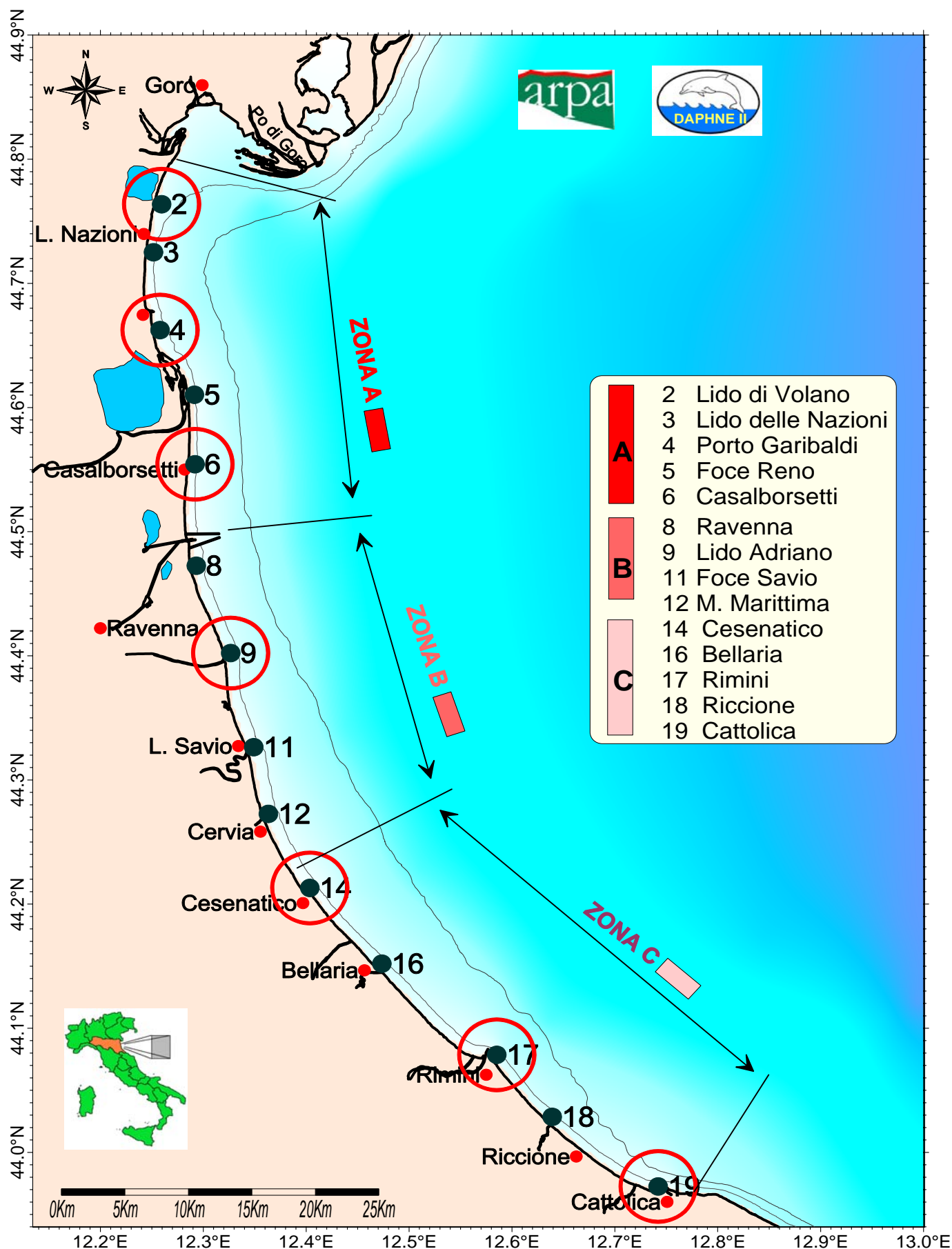
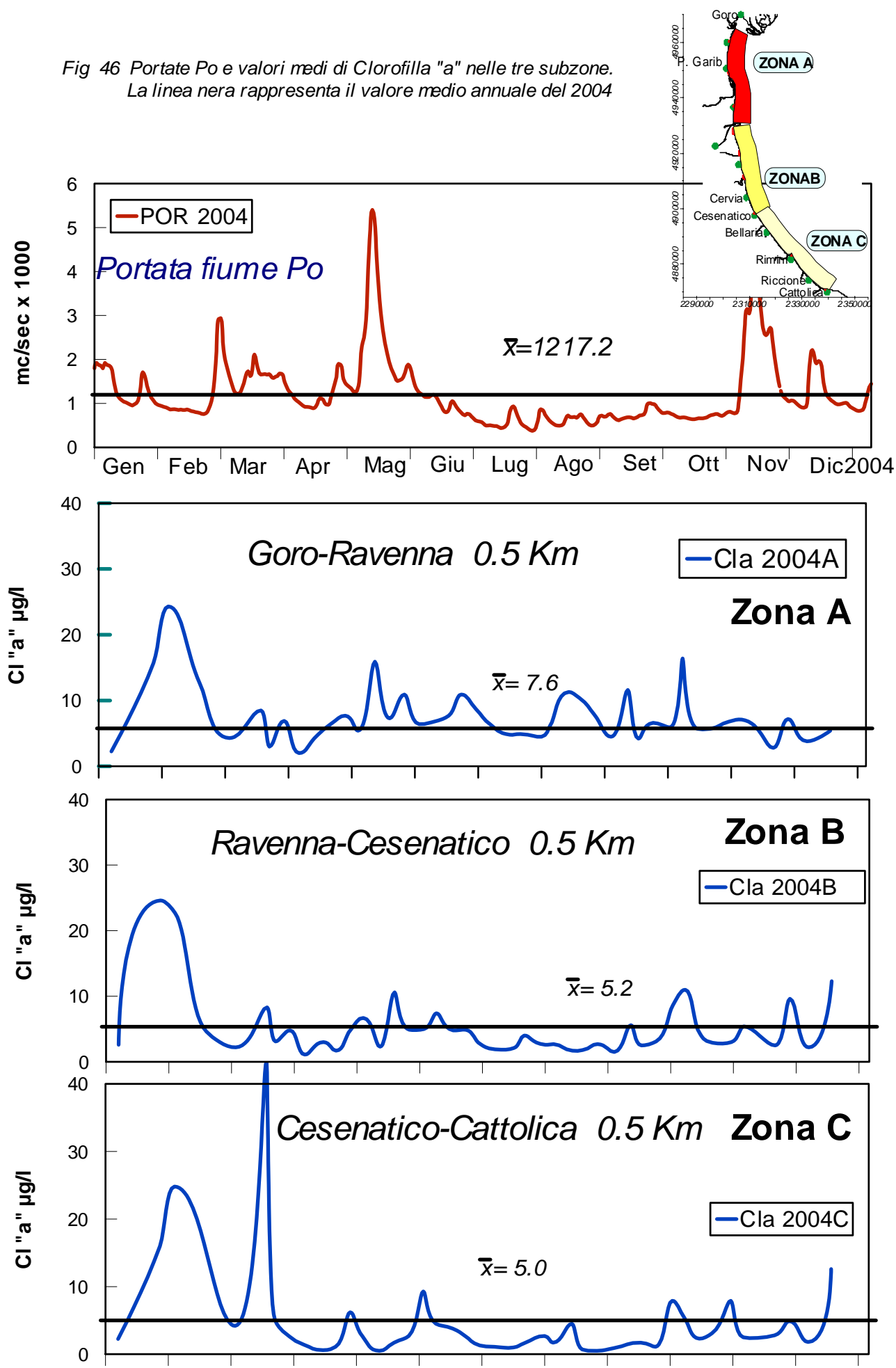


Fig. 45 Suddivisione in 3 subaree delle stazioni costiere (0.5 Km) monitorate. Nei cerchi in rosso sono evidenziate le stazioni costiere prese in considerazione per l'analisi degli andamenti delle variabili rilevate nelle campagne di monitoraggio

Fig 46 Portate Po e valori medi di Clorofilla "a" nelle tre subzone.
La linea nera rappresenta il valore medio annuale del 2004



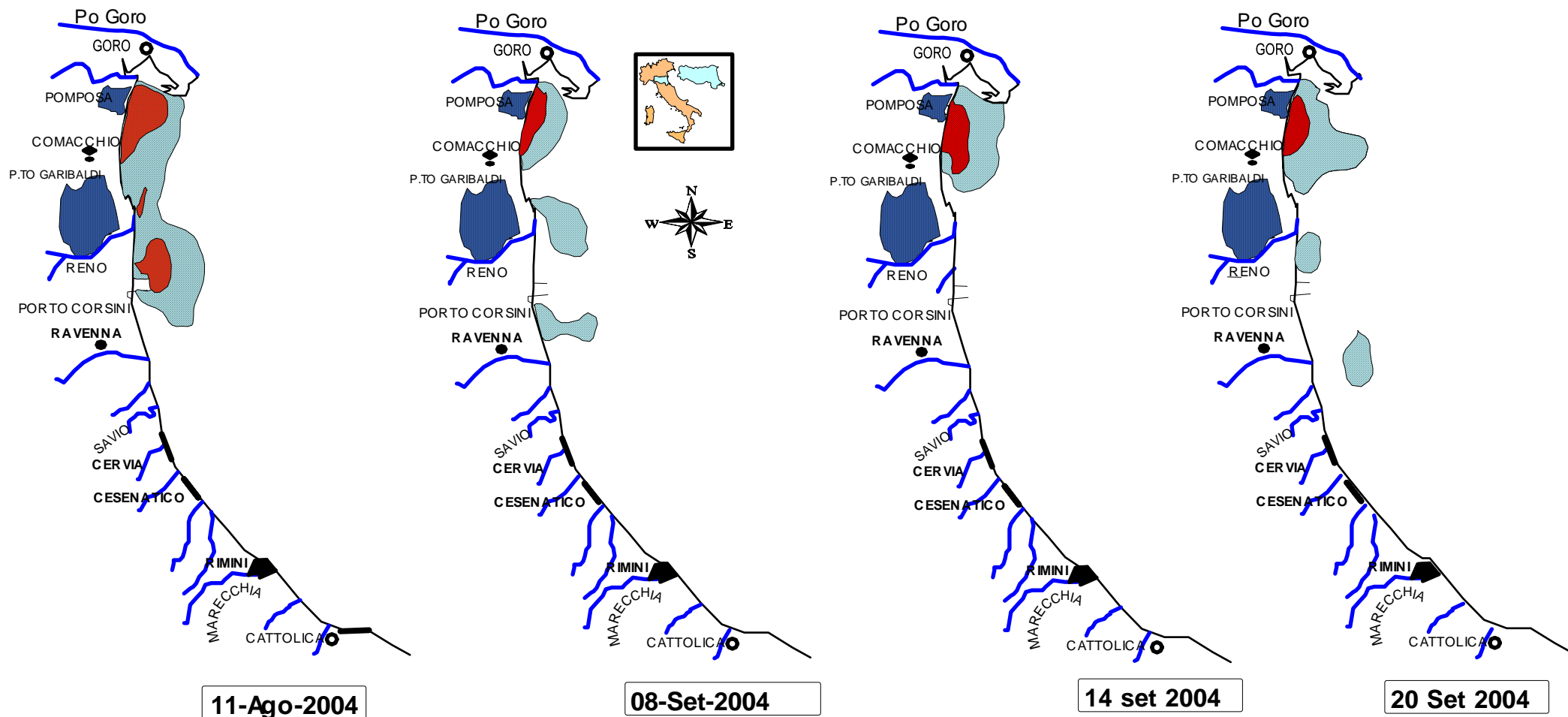


Fig. 47 Mappe di distribuzione delle condizioni anossiche (concentrazione di ossigeno disciolto inferiore a 1 mg/l) ed ipossiche (concentrazione di ossigeno disciolto compreso tra 1 mg/l e 3 mg/l) delle acque di fondo nel 2004, dal delta del Po a Cattolica e da costa fino a 10 Km al largo.

Diagramma TS - Marzo - Maggio - Settembre 2004

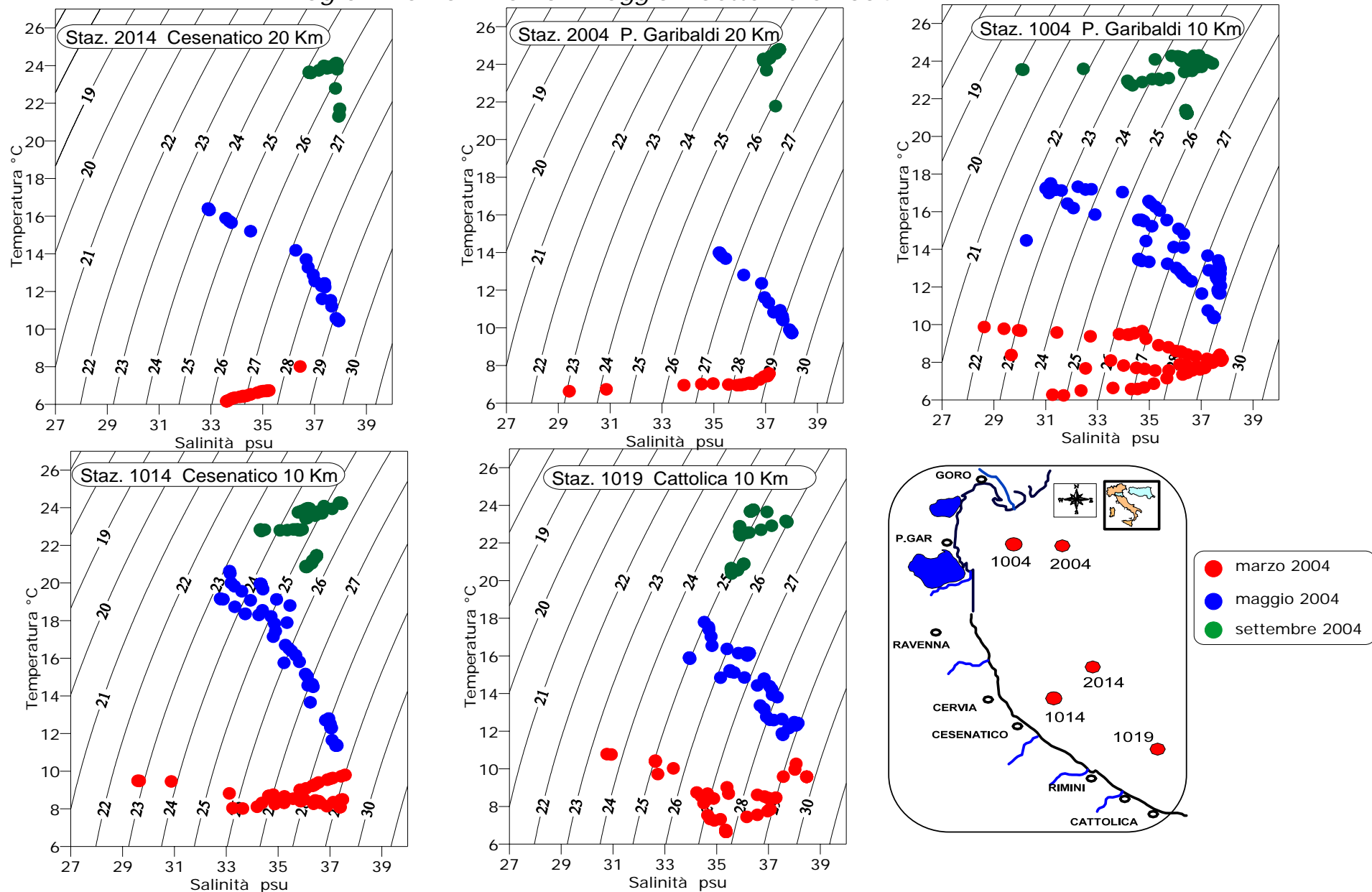


Fig. 48 Diagrammi T-S risultati dai profili verticali di temperatura e salinità nelle stazioni a 20 Km al largo di P. Garibaldi e Cesenatico e nelle stazioni a 10 Km dalla costa antistante P. Garibaldi, Cesenatico e Cattolica.

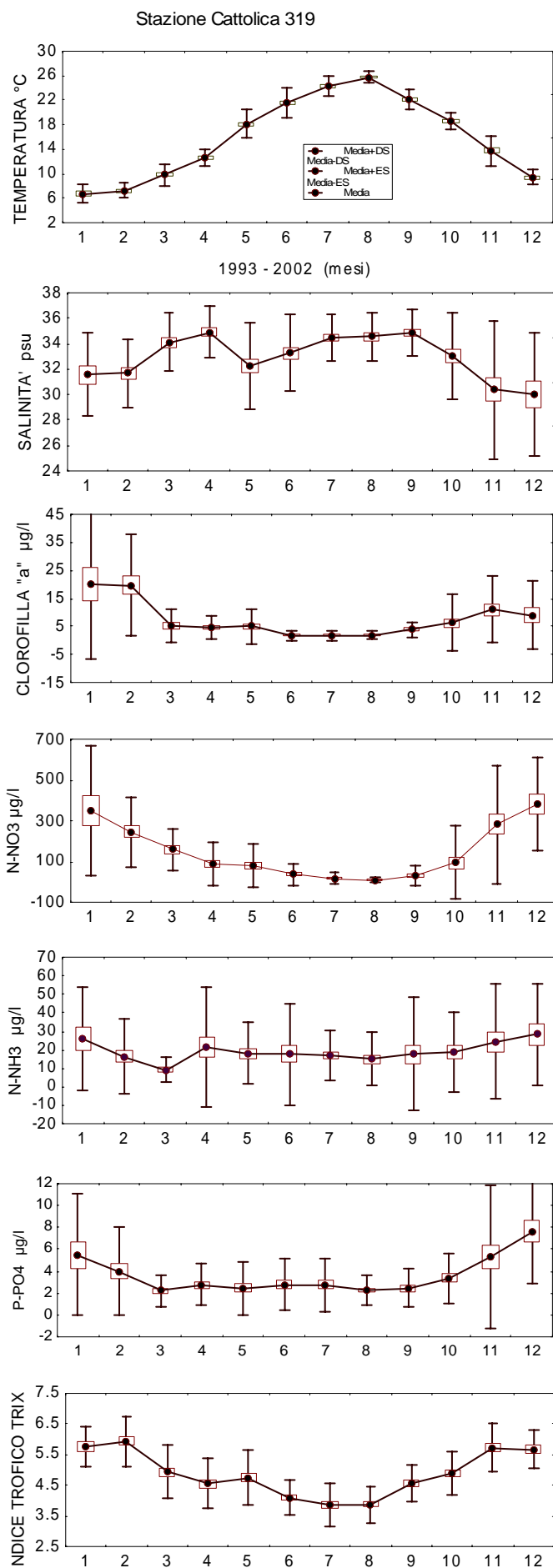
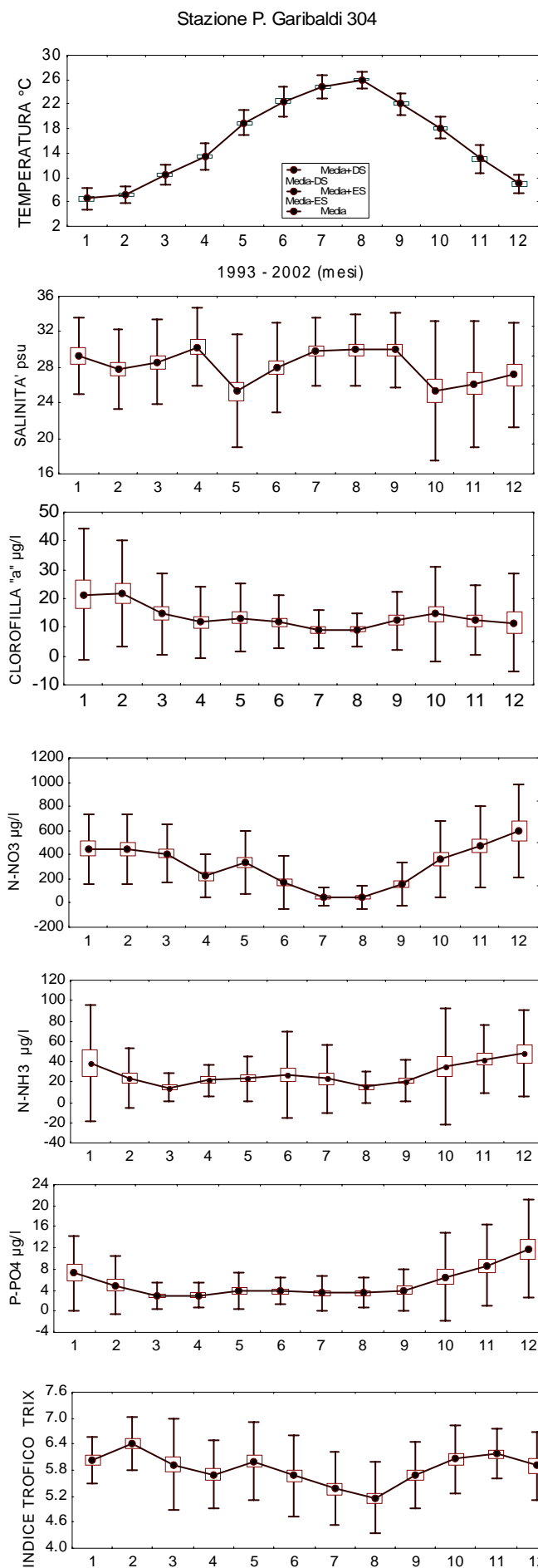


Fig 49 Medie climatologiche calcolate nelle stazioni a 3 Km dalla costa a P. Garibaldi (ST 304) e Cattolica (ST319). Sono rappresentati i valori medi mensili e la deviazione standard delle principali variabili chimico-fisiche calcolate per il periodo 1993-2002.

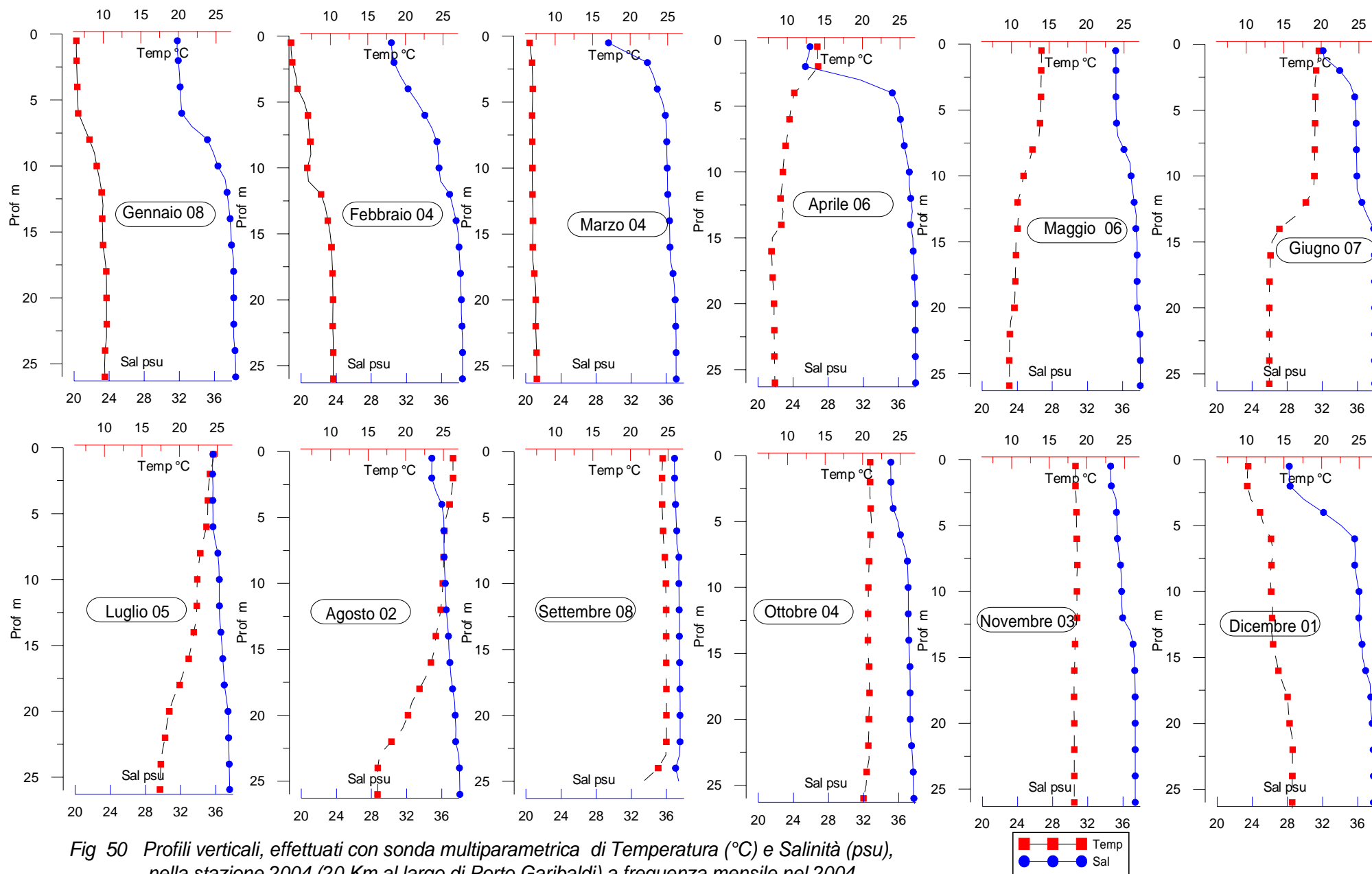


Fig 50 Profili verticali, effettuati con sonda multiparametrica di Temperatura (°C) e Salinità (psu), nella stazione 2004 (20 Km al largo di Porto Garibaldi) a frequenza mensile nel 2004

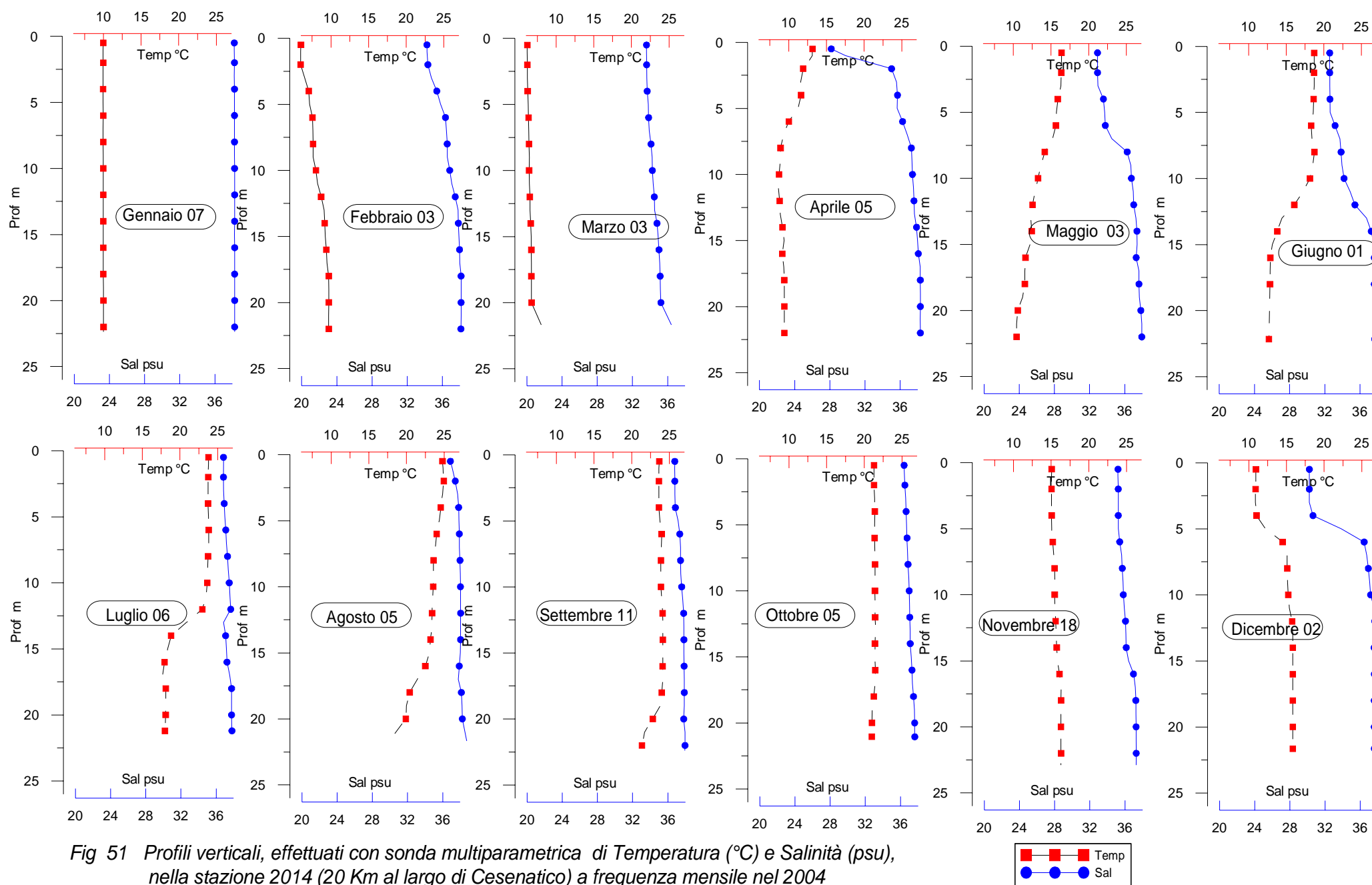


Fig 51 Profili verticali, effettuati con sonda multiparametrica di Temperatura (°C) e Salinità (psu), nella stazione 2014 (20 Km al largo di Cesenatico) a frequenza mensile nel 2004

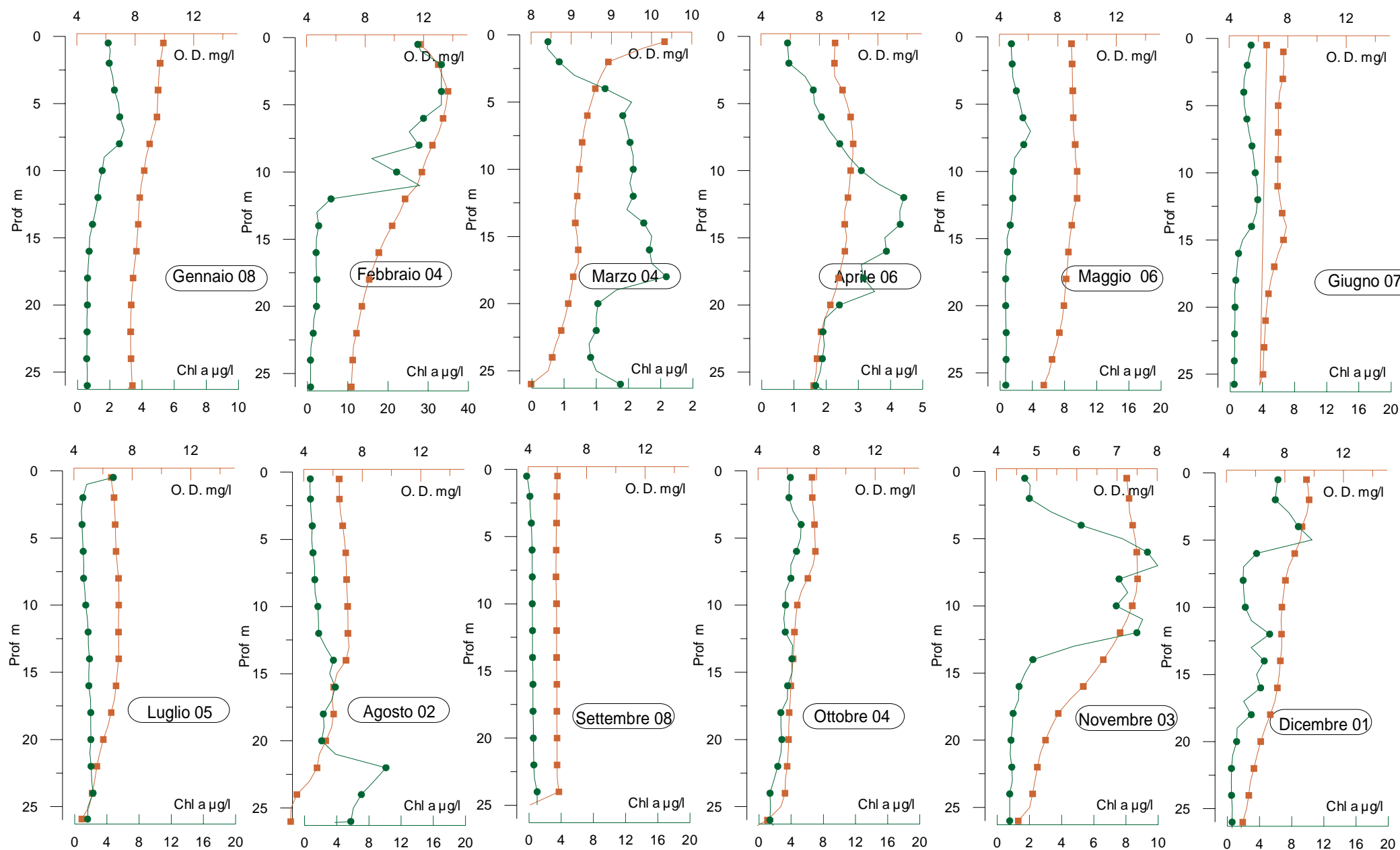
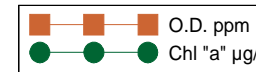


Fig 52 Profili verticali, effettuati con sonda multiparametrica di Ossigeno D. (mg/l) e Clorofilla "a" ($\mu\text{g/l}$), nella stazione 2004 (20 Km al largo di Porto Garibaldi) a frequenza mensile nel 2004



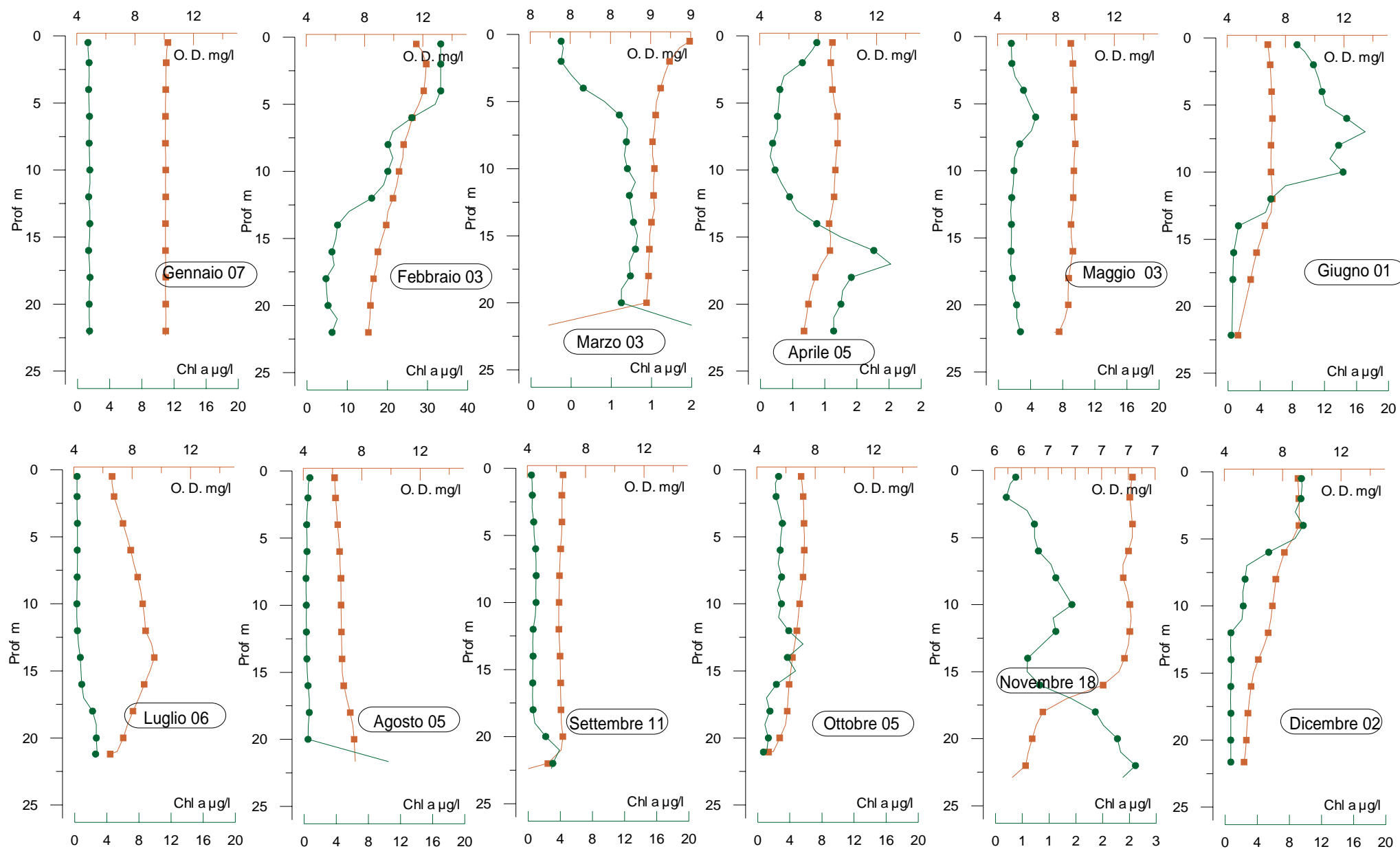


Fig 53 Profili verticali, effettuati con sonda multiparametrica di Ossigeno D. (mg/l) e Clorofilla "a" ($\mu\text{g/l}$), nella stazione 2014 (20 Km al largo di Cesenatico) a frequenza mensile nel 2004

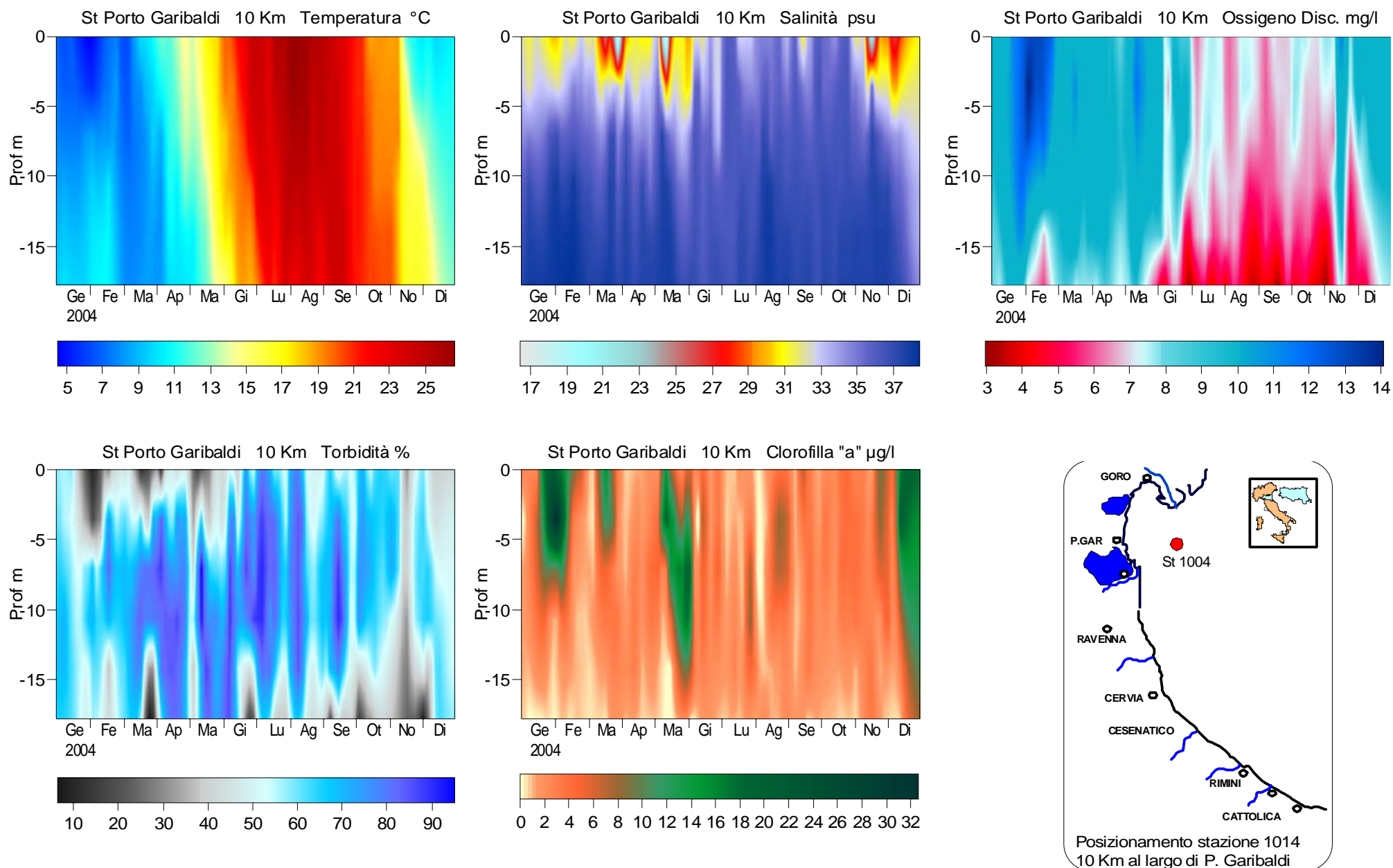


Fig. 54 *Isolinee di concentrazione della Temperatura, Salinità, Ossigeno disciolto, Torbidità e Clorofilla "a" rilevate nei monitoraggi settimanali, nella stazione 1004 (10 Km al largo di Porto Garibaldi), dalla superficie al fondo.*

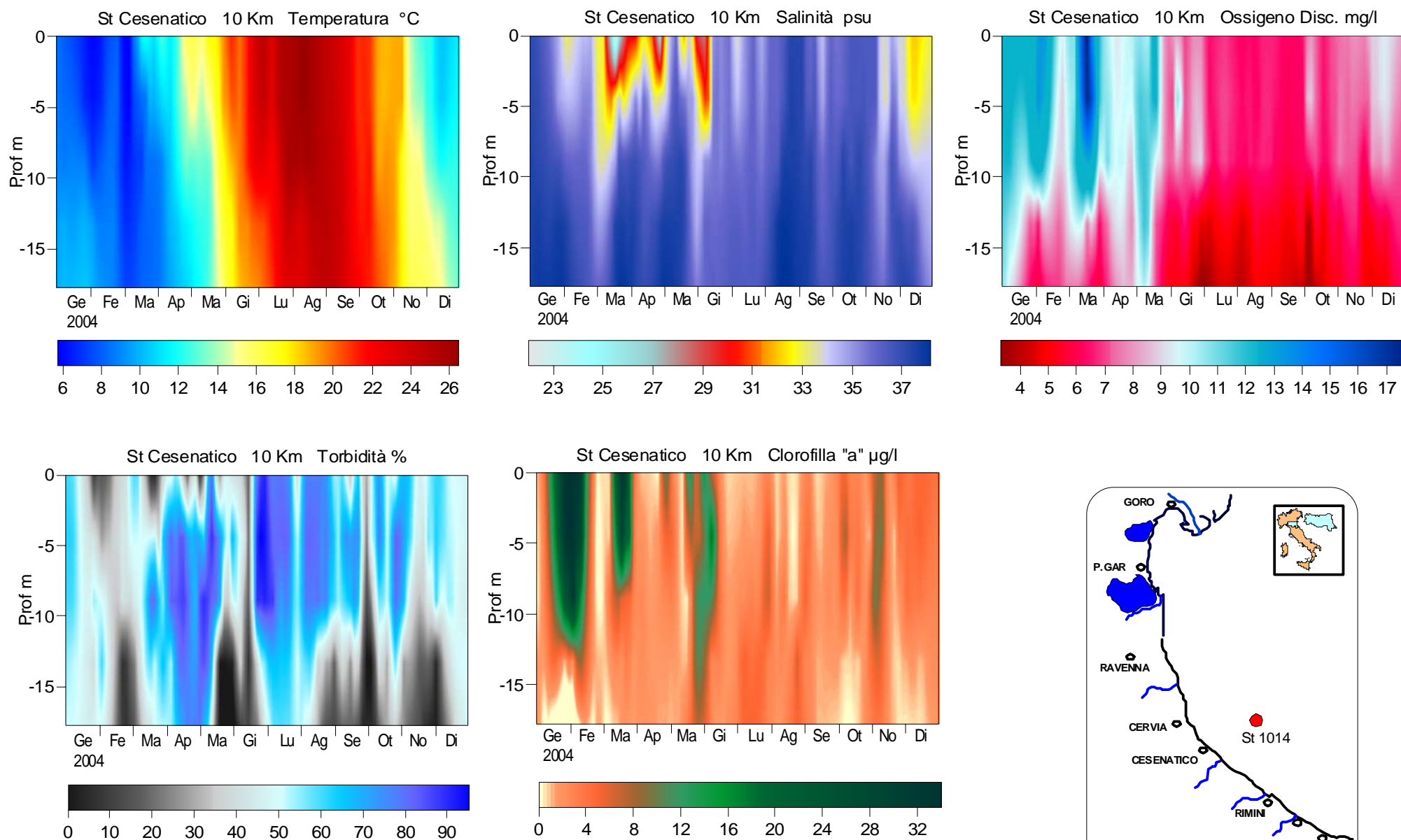
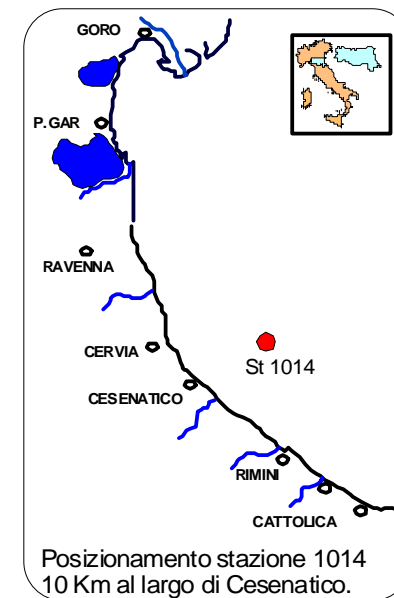


Fig. 55 Isolinee di concentrazione della Temperatura, Salinità, Ossigeno disciolto, Torbidità e Clorofilla "a" rilevate nei monitoraggi settimanali, nella stazione 1014 (10 Km al largo di Cesenatico), dalla superficie al fondo.



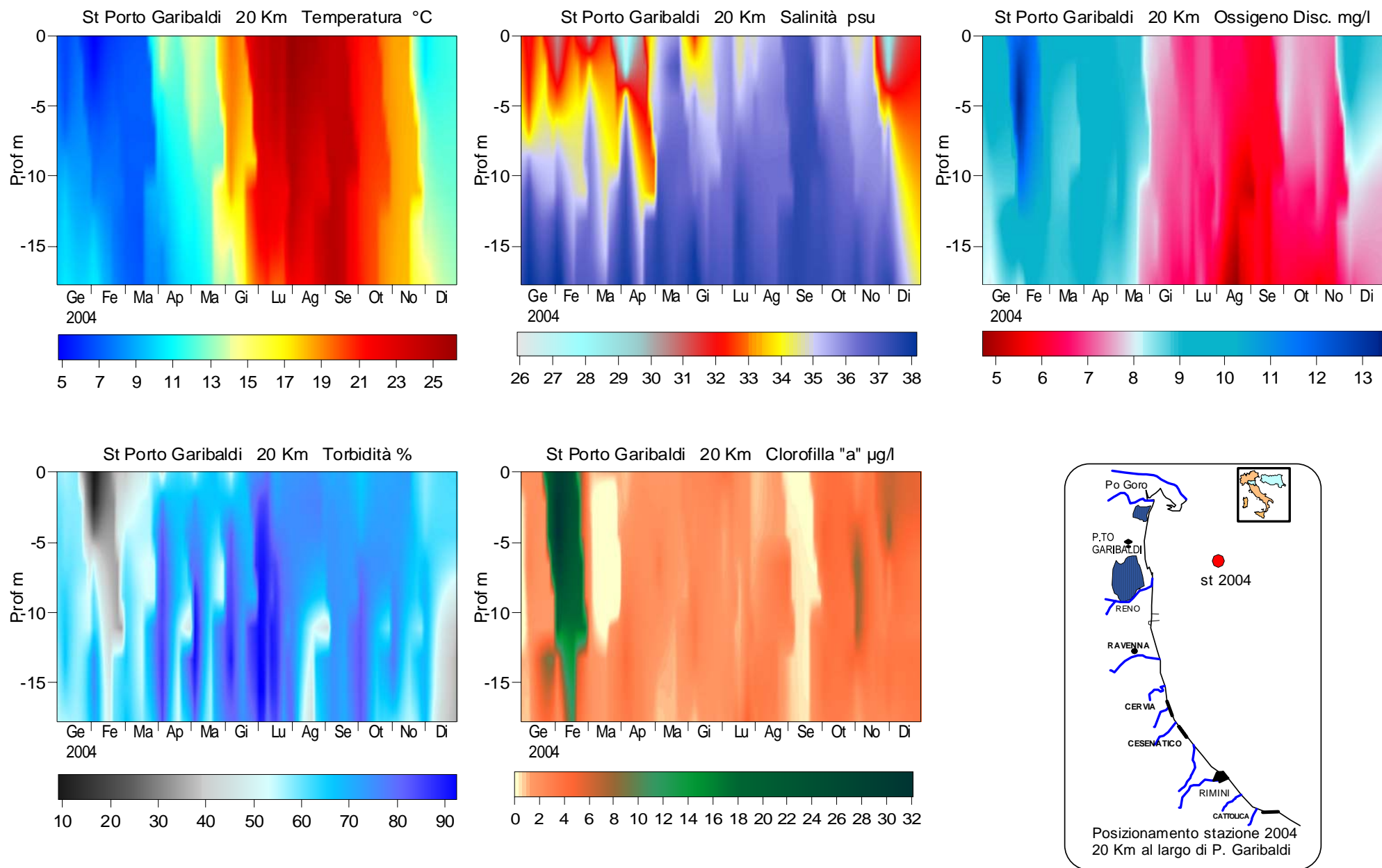


Fig. 56 *Isolinee di concentrazione della Temperatura, Salinità, Ossigeno disciolto, Torbidità e Clorofilla "a" rilevate nei monitoraggi settimanali, nella stazione 2004 (20 Km al largo di Porto Garibaldi), dalla superficie al fondo.*

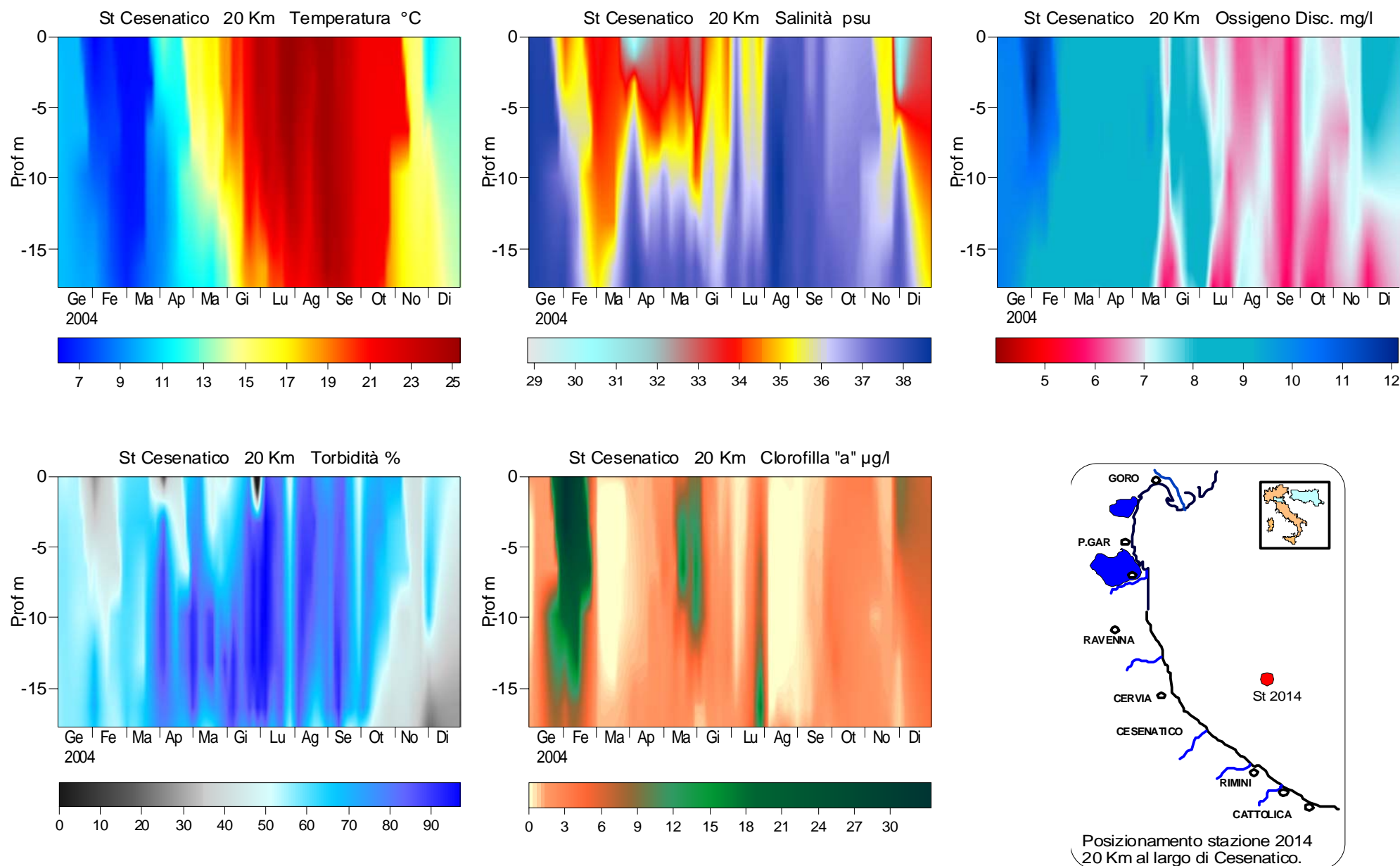


Fig. 57 Isolinee di concentrazione della Temperatura, Salinità, Ossigeno disciolto, Torbidità e Clorofilla "a" rilevate nei monitoraggi settimanali, nella stazione 2014 (20 Km al largo di Cesenatico), dalla superficie al fondo.

TEMPERATURA °C Sezione transetto Cesenatico 0-20 Km

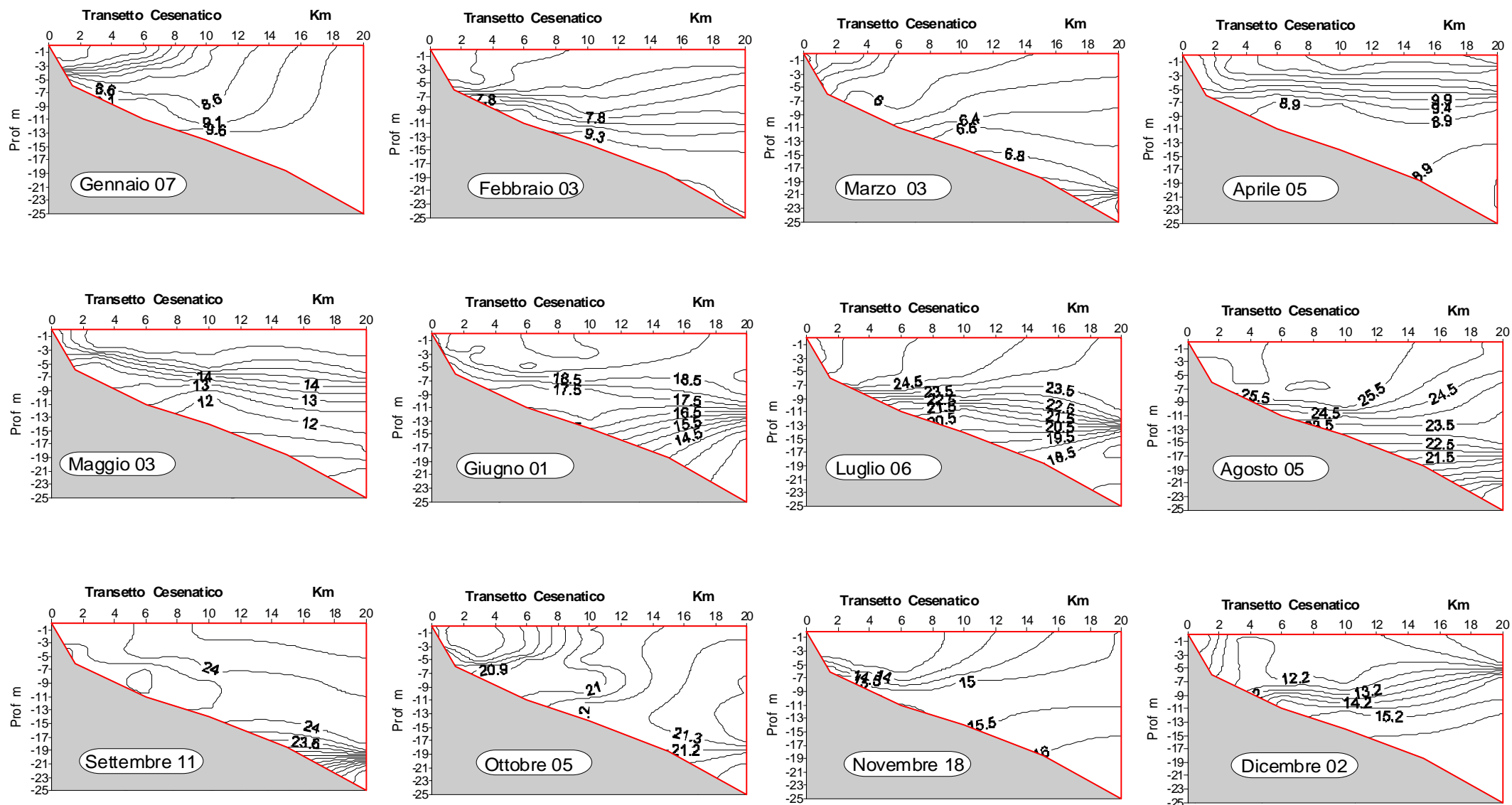


Fig. 58 Isolinee di concentrazione della Temperatura, lungo la sezione del transetto di Cesenatico fino a 20 Km al largo a frequenza mensile

TEMPERATURA °C Sezione transetto Porto Garibaldi 0-20 Km

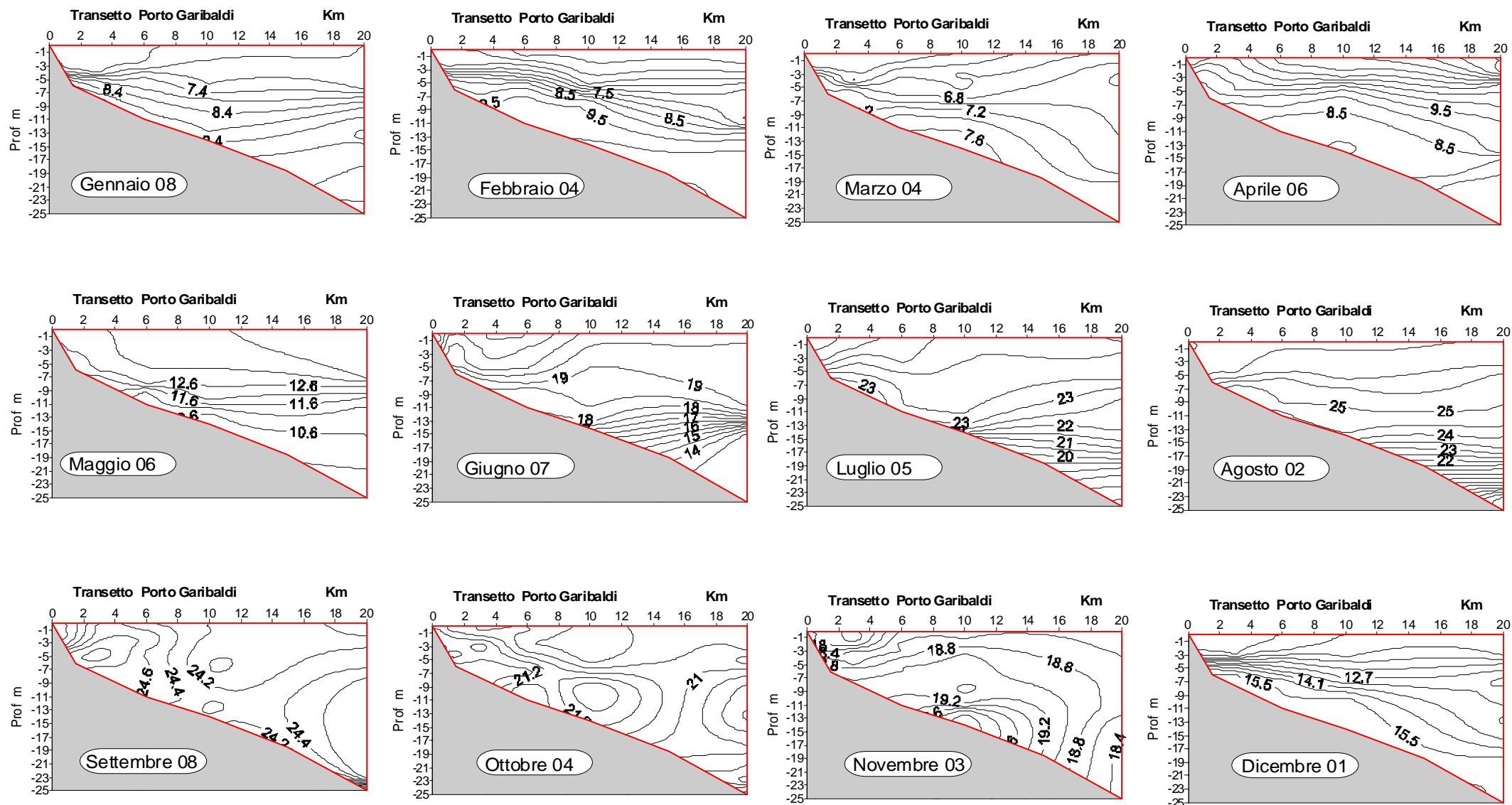


Fig. 59 Isolinee di concentrazione della Temperatura, lungo la sezione del transetto di Porto Garibaldi fino a 20 Km al largo a frequenza mensile

SALINITA' psu Sezione transetto Cesenatico 0-20 Km

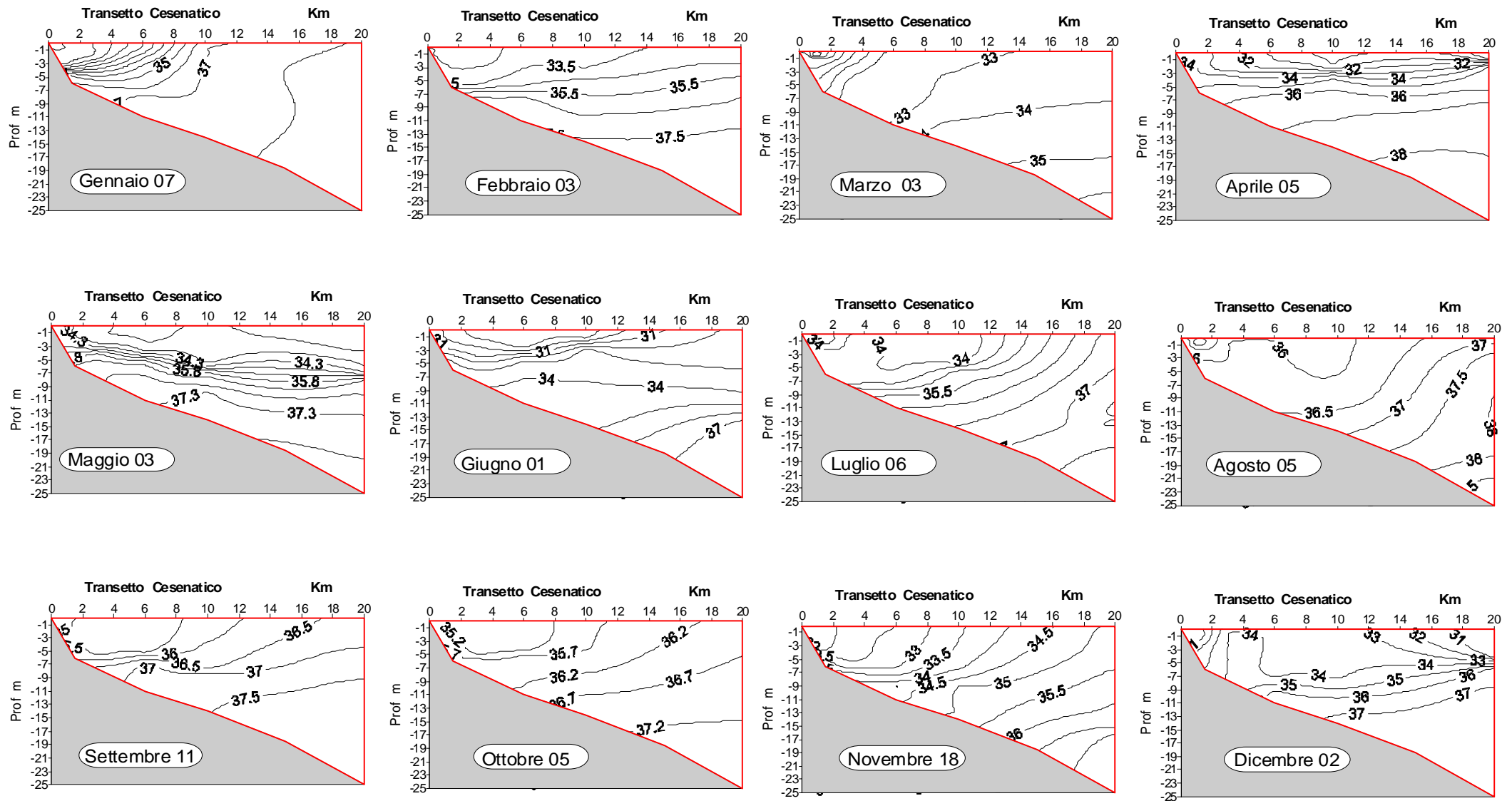


Fig. 60 Isolinee di concentrazione della Salinità, lungo la sezione del transetto di Cesenatico fino a 20 Km al largo a frequenza mensile

SALINITA' psu Sezione transetto Porto Garibaldi 0-20 Km

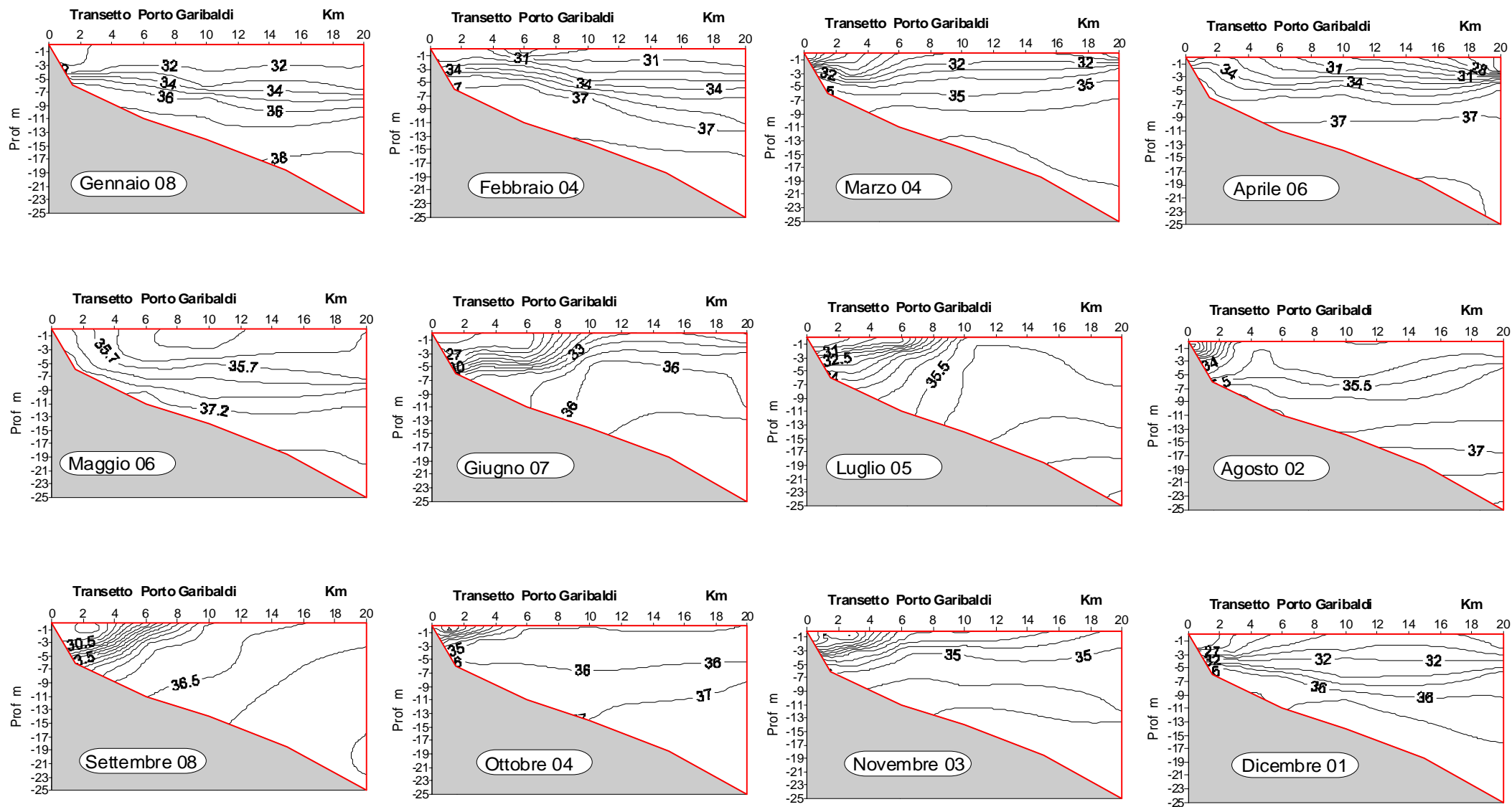


Fig. 61 Isolinee di concentrazione della Salinità, lungo la sezione del transetto di Porto Garibaldi fino a 20 Km al largo a frequenza mensile

OSSIGENO ppm Sezione transetto Cesenatico 0-20 Km

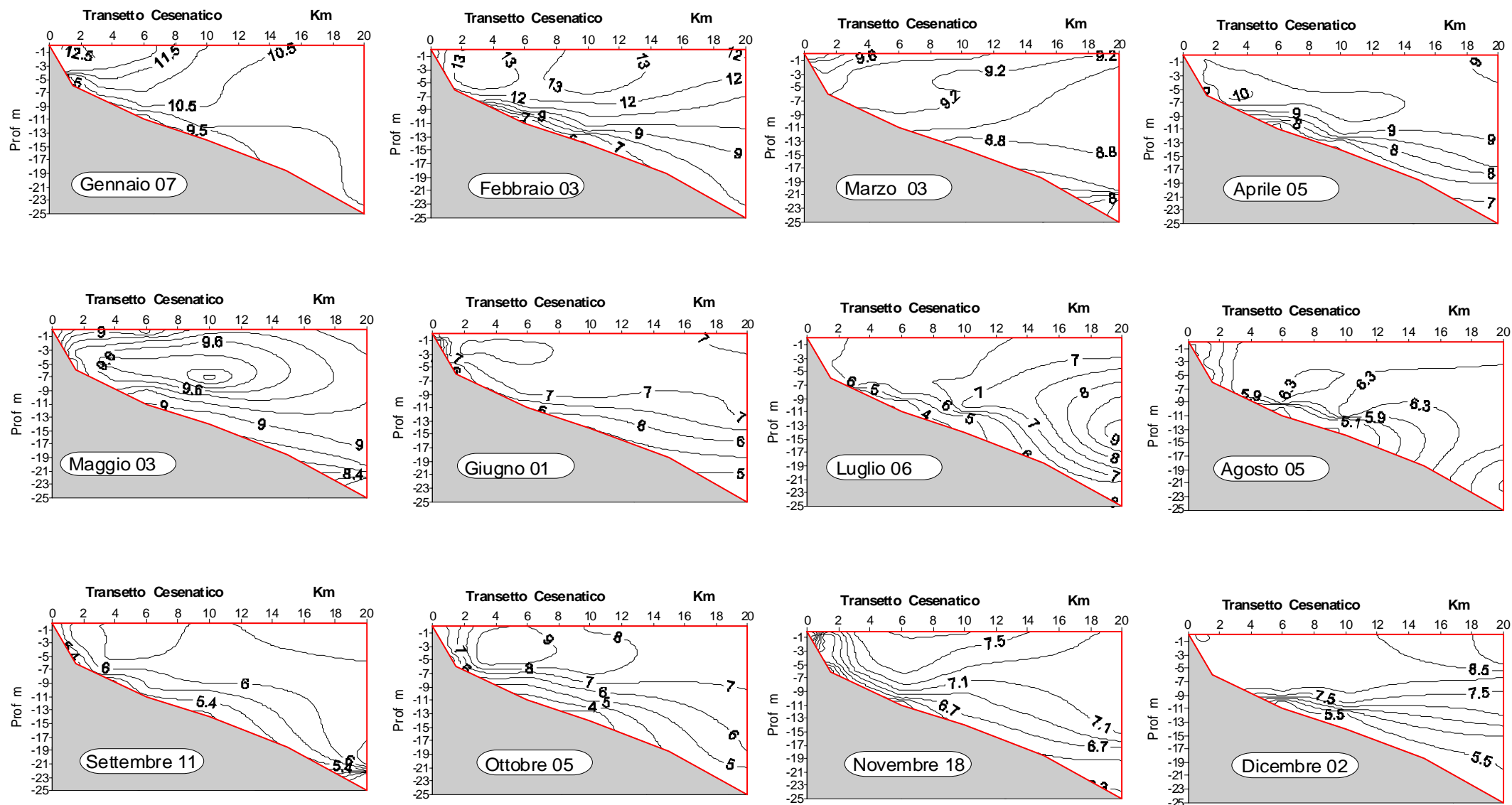


Fig. 62 Isolinee di concentrazione dell' Ossigeno, lungo la sezione del transetto di Cesenatico fino a 20 Km al largo a frequenza mensile

OSSIGENO ppm Sezione transetto Porto Garibaldi 0-20 Km

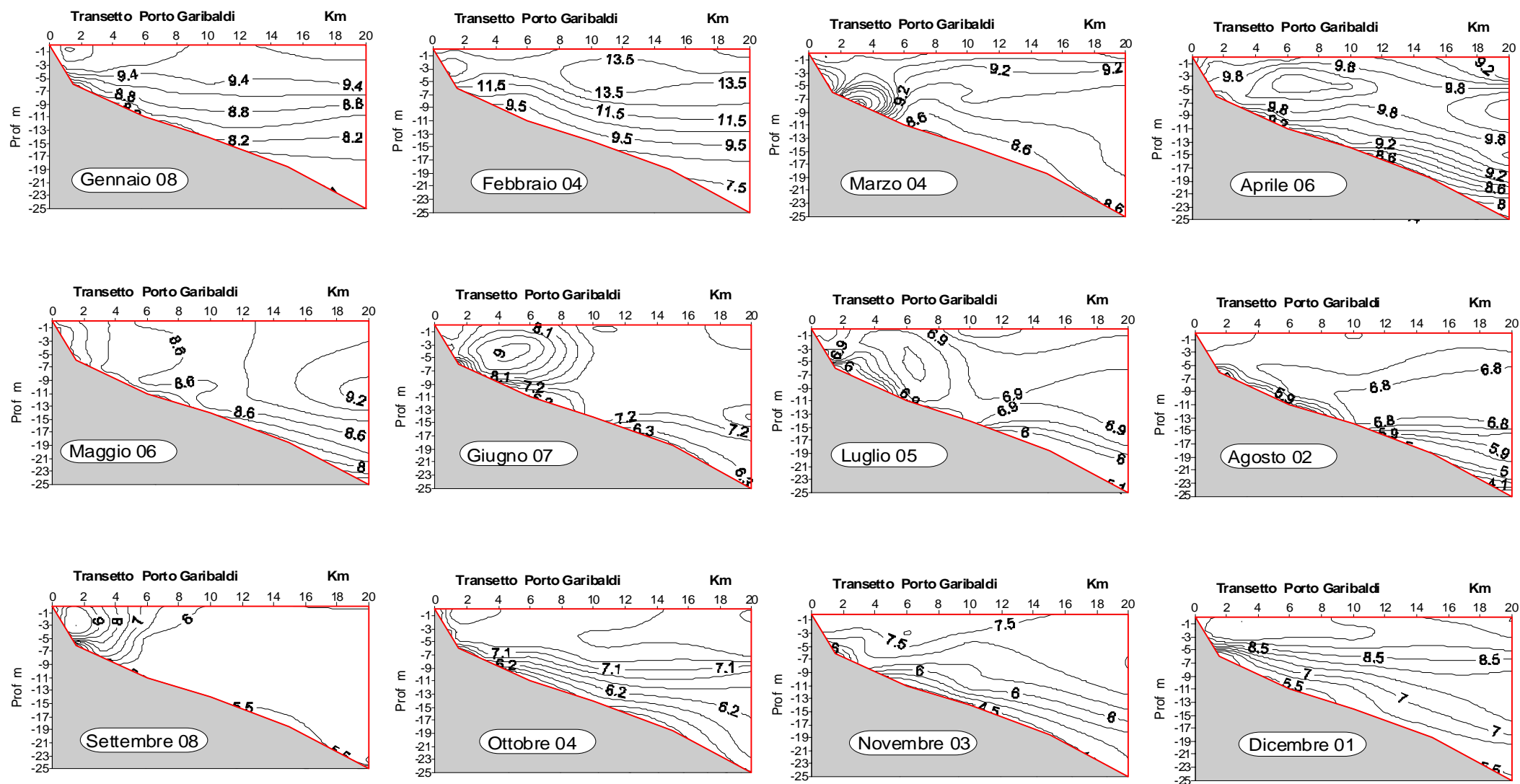


Fig. 63 Isolinee di concentrazione dell' Ossigeno, lungo la sezione del transetto di Porto Garibaldi fino a 20 Km al largo a frequenza mensile

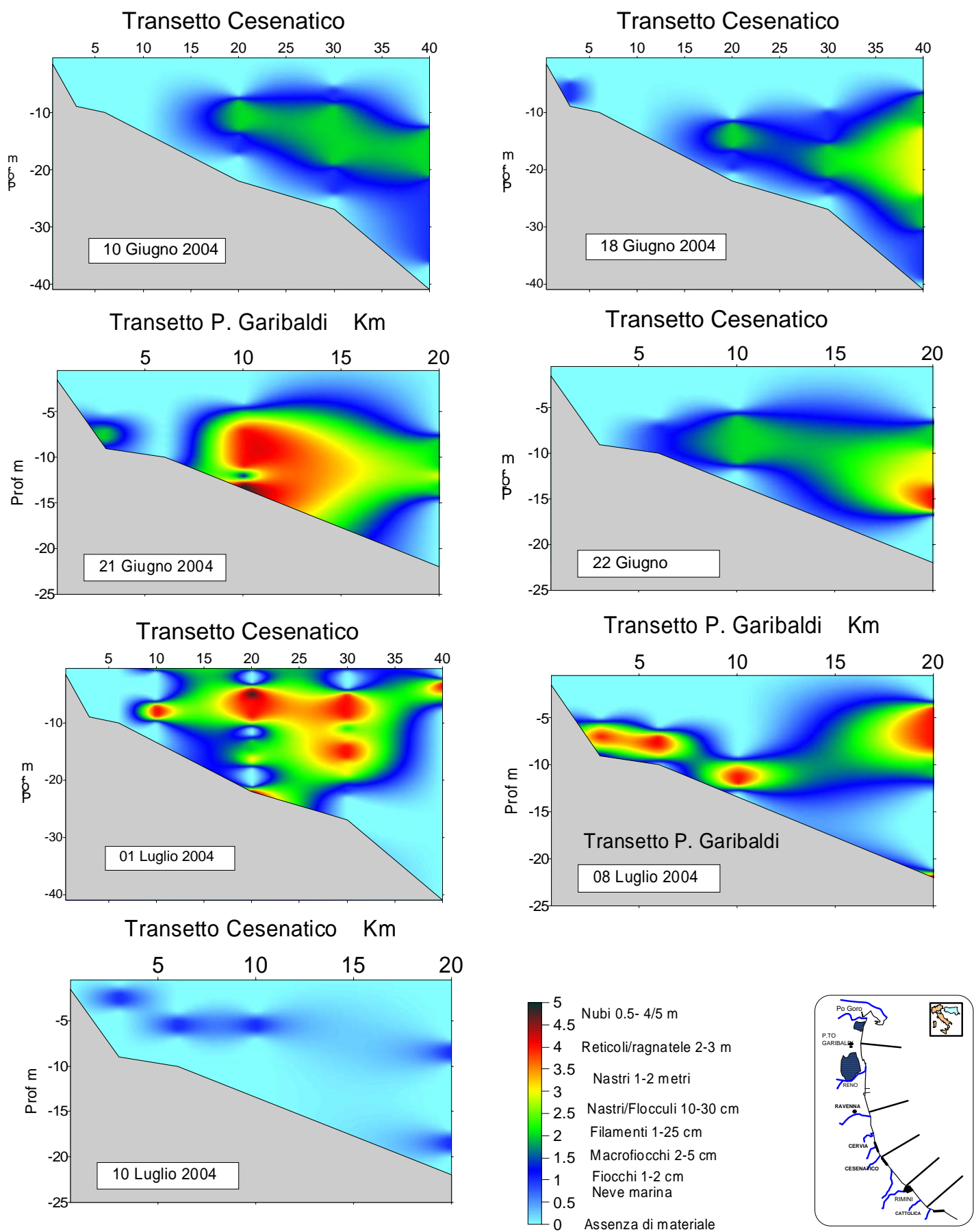


Fig 64 Evoluzione degli stati di aggregazione della mucillagine lungo i transetti da Cattolica a Porto Garibaldi nel periodo Giugno-Luglio 2004

