



(T, 1979; F, 19 1;  
C, T, 19 5; B, et al., 19 ; F,  
B, 1993; M, F, 1997; P, et al.,  
2001; O, et al., 2007; R, et al., 2010). W

12 39  
(T, et al., 199 );

(S, et al., 2010).

RNA (RNA) (M S,  
et al., 2001; L -G, et al., 2003),  
(C, et al., 2010), (B, et al.,  
2009; E, et al., 2011; S, et al., 2012). H

(P, L, 2009)

RNA

(PCR, 30\*3( TJ-14

221.9( -)TJT\*(, 2<sup>4</sup>)-7( 0 226. (







Fig. 2. P... 500... > 90%... B3 71 (B1-11, B3-3); B3 74... B1-B4... C1-C2... CKI... E1... E... R... TEFP... B...

**Table 2.** Diversity indices of TEF1 sequences

| Sequence ID            | B1  | B2   | B3   | B4                                    | C1  | C2  | E1  | Total |
|------------------------|---|--|--|---------------------------------------|---|---|---|-------|
| N. ... SEQ             | 5627  | 3264   | 257  | 4540                                  | 436   | 3730  | 6702  | 30 09 |
| N. ... SEQ             | 23 1  | 11 1   | 761  | 402                                   | 1713  | 1227  | 20 3  | 974   |
| N. ... cob SEQ         | 2362  | 1176   | 753  | 391                                   | 1705  | 1210  | 2001  | 959   |
| SEQ ... P ...          | 430   | 23   | 2 7  | 17                                    | 260   | 46  | 1167  | 3245  |
| N. ... SEQ ... 99% SEQ | 97  | 4  | 52   | 11                                    | 5   | 156   | 112   | 400   |
| C ... 99%              | 91.39   | 93.69  | 91.9   | 64.70                                 | 9.23  | 92.31   | 95.   |       |
| SEQ ... (%)            |   |  |  |                                       |   |   |   |       |
| N. ... SEQ             | 5   | 42   | 33   |                                       | 42  | 2   | 7   | 243   |
| S. ... ( ... )         | <i>Pfiesteria</i><br>(3)<br>U<br>(55)   | <i>Pfiesteria</i><br>(4)<br>U<br>(3)   | <i>Scopliella</i><br>(1)<br><i>Pfiesteria</i><br>(3)<br>U<br>(29)  | U<br>( )                              | <i>Pfiesteria</i><br>(3)<br><i>Scopliella</i><br>(7)<br>U<br>(32)   | <i>Scopliella</i><br>(3)<br><i>Pfiesteria</i><br>(3)<br>U<br>(76)   | <i>Scopliella</i><br>(3)<br>U<br>(75)   |       |
| SEQ ... G ...          | 561   | 365  | 0  | 97                                    | 616   | 6   | 1 0   | 1967  |
| N. ... SEQ ... 99% SEQ | 170   | 0  | 17   | 22                                    | 121   | 4   | 44  | 279   |
| C ... 99%              | 92. 6   | 9. 6   | .75  | 7.62                                  | 92.37   | 97.05   | 90.05   |       |
| SEQ ... (%)            |   |  |  |                                       |   |   |   |       |
| N. ... SEQ             | 65  | 40   | 9  | 11                                    | 63  | 3   | 29  | 156   |
| S. ... (N. ... )       | <i>Osteopsis</i><br>(1)<br><i>Coolia</i><br>(6)<br><i>Alexandrium</i><br>(2)<br><i>P. otoceatum</i><br>(1)<br><i>Goryaulax</i><br>(1)<br>U<br>(54)                      | <i>Osteopsis</i><br>(1)<br><i>Coolia</i><br>(9)<br>U<br>(30)   | <i>Alexandrium</i><br>(2)<br><i>P. otoceatum</i><br>(2)<br><i>Goryaulax</i><br>(1)<br>U<br>(4)   | <i>Coolia</i><br>(5)<br>U<br>(6)      | <i>Coolia</i><br>(13)<br><i>Alexandrium</i><br>(1)<br><i>Gambie discus</i><br>(1)<br><i>Gambie discus</i><br>(4)<br>U<br>(44) | U<br>(3)<br><i>Osteopsis</i><br>(1)<br><i>Alexandrium</i><br>( )<br><i>Gambie discus</i><br>(1)<br><i>Gambie discus</i><br>(4)<br>U<br>(15) | <i>Osteopsis</i><br>(1)<br><i>Alexandrium</i><br>( )<br><i>Gambie discus</i><br>(1)<br><i>Gambie discus</i><br>(4)<br>U<br>(15) |       |
| SEQ ... G ...          | 911   | 23   | 213  | 10                                    | 373   | 79  | 14  | 1 3   |
| N. ... SEQ ... 97% SEQ | 44  | 22   | 23   | 4                                     | 13  | 16  | 2   | 101   |
| C ... 97%              | 99.01   | 99.9   | 97.65  | .90                                   | 99.19   | 97.46   | 99.99   |       |
| SEQ ... (%)            |   |  |  |                                       |   |   |   |       |
| N. ... SEQ             | 40  | 26   | 21   | 7                                     | 11  | 14  | 2   | 2     |
| S. ... ( ... )         | <i>Gymnodinium</i><br>(2)<br><i>Kalodinium</i><br>(1)<br><i>Akashiwo</i><br>(1)<br><i>Amphidinium</i><br><i>cateae</i><br>(1)<br><i>Amphidinium</i><br>(1)<br>U<br>(34) | <i>Gymnodinium</i><br><i>catenatum</i><br>(1)<br><i>Gymnodinium</i><br>(3)<br><i>Kalodinium</i><br>(1)<br><i>Akashiwo</i><br>(1)<br><i>Amphidinium</i><br>(1)<br>U<br>(19) | <i>Gymnodinium</i><br>(1)<br><i>Kalodinium</i><br>(3)<br><i>Kalodinium</i><br><i>micum</i><br>(1)<br><i>Akashiwo</i><br>(2)<br>U<br>(14) | <i>Gymnodinium</i><br>(2)<br>U<br>(5) | <i>Gymnodinium</i><br>(1)<br><i>Akashiwo</i><br>(1)<br><i>Amphidinium</i><br>(3)<br>U<br>(6)                                  | <i>Gymnodinium</i><br>(2)<br><i>Amphidinium</i><br>(5)<br>U<br>(7)  | <i>Amphidinium</i><br>(2)   |       |
| SEQ ... P ...          | 9   | 1 6  | 7  | 2                                     | 165   | 3   | 411   | 9     |
| N. ... SEQ ... 99% SEQ | 23  | 43   | 2  | 5                                     | 34  | 2   | 57  | 126   |
| C ... 99%              | 9.  | 91.39  |  | 92. 5                                 | 94.54   | 66.66   | 94.64   |       |
| SEQ ... (%)            |   |  |  |                                       |   |   |   |       |
| N. ... SEQ             | 20  | 41   | 2  | 5                                     | 34  | 2   | 4   | 97    |

... (F . 4). S, 94% ...



Fig. 3. P *col*, G, TEFP, B, 70-90%, 500, <70%, E, OTU, >90%, B4 39 3 (B3-6, B4-2, C2-1); B4 39 3, B3, 2, B4 1, C1, B1-B4, B, C1-C2, CKI, E1, E, R.





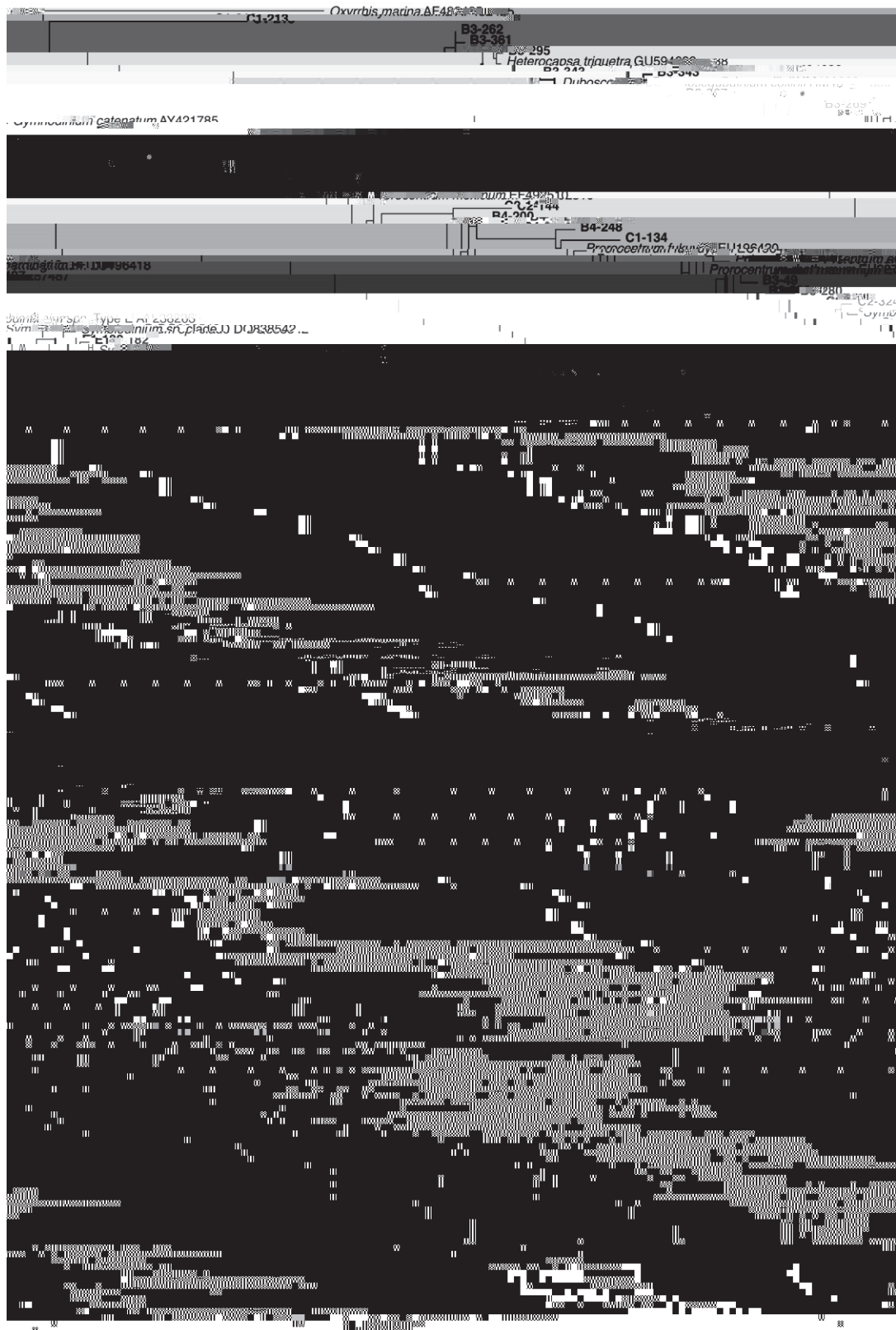


Fig. 5. P . . . . . SSJ . . . . . TEPF . . . . . B . . . . .  
 500 . . . . . > 90% . . . . . 70 90% . . . . .  
 < 70%. B1-B4, . . . . . B . . . . . C1-C2 . . . . . CKI . . . . . E1 . . . . . E . . . . .

9.46% TAFP (T<sub>2</sub>, T<sub>3</sub>).

P. *cob*  
D. (G, G,  
P, P, S<sub>1</sub>, S<sub>2</sub>)  
(F<sub>1</sub>, F<sub>2</sub>, S<sub>1</sub>, S<sub>2</sub>, S<sub>3</sub>),

*Heterocapsa*, *Amphidinium*, Δ  
SSU RNA,  
*cob*,  
(Z et al., 2005),

H, *cob*, (Z et al., 2005;  
L et al., 2009);

D. (P, 1999; O et al., 2012; M  
et al., 2012). W

H (TAFP)

Experimental procedures  
W.  
*cob*, 50%



CKI;

T Padina  
Sa gassum A 750  
1  
200 500  
T 5  
T  
> 100







M... P... *J Ma Biol Assoc U K* **88**: 1-15.

H... M.J. (199 ) *G...* ( ), *J Phy col* **34**: 661-666 .

H... M., L..., B.S. (200 ) M...

P... P... (D... B... C... C... *J Phy col* **44**: 451-466.

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*eHa mfu*  
 (20169)  
~~*bfhau*~~

A.lgaeTJ/F2 1 Tf36.49160 ID(4:  
 Hughb-leel

An. Wa.

V. G. M.  
*Aquat Microb Ecol* 47: 223-237.

O., R.J.S., M., S.A., S., A., R., L.,  
J., K.S. (2012) W.

M. 4. 1-3 1 1-3 .9( )TJ-3 0( )-3T ( )TJ/F4 .1153.77

> 90%,  
70-90%  
< 70%  
OTU  
E1 344 (E1-46, C1-2); E1 344  
OTU/  
46 E1 2

C1. B1-B4, B, C1-C2