<Supplementary Materials>

Phytoplankton-based production of the clam *Corbicula japonica* in a low-turbidity temperate estuary as identified by fatty acid biomarkers and stable isotopes

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Table S1. Summary of FA biomarkers of putative carbon sources from literature.

Carbon sources	Class	FA biomarkers	References
Phytoplankton	Chlorophytes	C18:2ω6, C18:3ω3	[71]
		C18:3ω3	[57,58]
	Cryptophytes	C18:3ω3, C18:4ω3, C20:5ω3, C22:6ω3	[37]
		ω3/ ω6 ratio	
	Diatoms	C20:5ω3	[20,55]
			[72,73]
		C16:1ω7	
	Cyanophytes	C18:3ω3, C18:3ω6	[74]
		SFAs	[37]
	Dinoflagellates	C18:4ω3	[20,75]
			[56]
		C22:6ω3	
Detritus		C16:0, C18:0, C22:0	[59]
		C22:0 + C24:0	[76]
Vascular plant		C20 and C22 SFAs (Long chain SFAs)	[77]
Terrestrial matter		C18:2ω6	[55]
		C18:2ω6 + C18:3ω3	[78]
Bacteria		Branched and odd-chain	[78]
		C18:1ω7	[79]
		C13:0 + C15:0 + C17:0	[80]

Table S2. Main/preferred carbon (food) sources inferred from fatty acid biomarkers of bivalve species.

Species	Main/preferred food sources inferred from FA biomarkers	FA biomarkers	References
Crassostrea cucullata	Dinoflagellates, diatoms, brown algae	C22:6ω3, C20:5ω3, C18:1ω9	[81]
Crassostrea gigas	Dinoflagellates, diatoms	C22:6ω3, C20:5ω3	[82]
Crassostrea rhizophorae	Not inferred	C22:6ω3, C20:5ω3	[83]
Paphies australis	Dinoflagellates, diatoms	C22:6ω3, C20:5ω3	[82]
Quidnipagus palatum (Jan–July)	Diatoms	C20:5ω3	[84]
Quidnipagus palatum (July–Nov)	Vascular plants, bacteria	Long Chain-SAFAs, Bacterial FAs (C15:0 and C17:0, iso and anteiso, C18:1ω7)	[84]
Quidnipagus palatum (Nov–Jan)	Macroalgae, phytoplankton	C18:3ω6, C22:6ω3, C20:5ω3	[84]
Austrovenus stutchburyi	Dinoflagellates, diatoms	C22:6ω3, C20:5ω3	[82])
Geloina coaxans	Mangrove detritus, bacteria, zooplankton	C18:3ω6, C18:3ω3, C18:1ω9, C16:1ω7, C20:1ω9, Bacterial FAs (odd Branched FAs, C18:1ω7),	[85]
Corbicula japonica	Bacteria	C18:1ω7/C18:1ω9 > 1 Iso and anteiso C17:0	[10]
Corbicula japonica	Not inferred	C16:1ω7, C18:1ω9, C18:1ω7, C18:3ω3, C20:5ω3, C22:6ω3	[61]

Table S3. One-way ANOVA was employed to test the significant difference between size groups.

Site	Size	Length (mm)	$\delta^{13}C$ (‰)	$\delta^{15}N$ (‰)
1	2–5	3.81 ± 0.48 (35)	-25.2 ± 0.1^{bc} (4)	7.2 ± 0.7^{a} (4)
	4–7	5.44 ± 0.74 (22)	-25.7 ± 0.0^{a} (4)	8.1 ± 0.1^{b} (4)
	6–8	7.03 ± 0.54 (4)	-25.1 ± 0.1^{c} (4)	9.2 ± 0.0^{d} (4)
	7–9	8.04 ± 0.61 (13)	-25.3 ± 0.4^{bc} (4)	8.2 ± 0.0^{b} (4)
	9–11	10.20 ± 0.30 (13)	-25.6 ± 0.0^{ab} (4)	8.2 ± 0.2^{b} (4)
	10–14	12.34 ± 1.39 (4)	-25.0 ± 0.1^{c} (4)	9.1 ± 0.1^{cd} (4)
	11–14	12.54 ± 0.59 (4)	-25.1 ± 0.1^{c} (4)	8.5 ± 0.4^{bc} (4)
	13–15	14.05 ± 0.58 (4)	-24.7 ± 0.2^{d} (4)	8.8 ± 0.4^{bcd} (4)
	mean		–25.3 ± 0.3 (32)	8.4 ± 0.6 (32)
	ANOVA (between groups)		$F_{7,24} = 15.836$; $P < 0.001^{*}$	
2	4–9	7.18 ± 1.29 (21)	-24.5 ± 0.3^{bc} (4)	7.7 ± 0.4^{ab} (4)
	9–12	10.62 ± 0.92 (14)	-25.0 ± 0.2^{a} (4)	8.0 ± 0.5^{b} (4)
	12–15	14.21 ± 0.84 (12)	-24.7 ± 0.1^{ab} (4)	7.8 ± 0.3^{b} (4)
	15–18	16.90 ± 0.92 (6)	-24.9 ± 0.2^{ab} (4)	8.0 ± 0.1^{b} (4)
	18–20	19.08 ± 0.55 (7)	-25.0 ± 0.1^{a} (4)	7.2 ± 0.1^{a} (4)
	20–25	23.60 ± 1.63 (3)	-24.3 ± 0.1^{c} (4)	7.4 ± 0.1^{ab} (4)
	mean		–24.7 ± 0.3 (24)	7.7 ± 0.3 (24)
	ANOVA (between groups)		$F_{5,18} = 14.739$; $P < 0.001^{*}$	

Means followed by the different superscript letters are significantly different ($P < 0.05$, Tukey post hoc test). Asterisks indicate significance at $P < 0.05$.

Table S4. FA composition (% of total FAs) of putative food sources [E-SPOM, R-SPOM, and *P. australis*] and results of two-way ANOVA based on main factors of the month and source type. The number of samples (*n*) is two for all cases.

FA	E-SPOM				R-SPOM				*P. australis*				*P*		
	Aug 2020	Jan 2021	Mar–Apr 2021	Jun 2021	Aug 2020	Jan 2021	Mar–Apr 2021	Jun 2021	Aug 2020	Jan 2021	Mar–Apr 2021	Jun 2021	Month	Type	Interaction
C13:0+C15:0+C17:0	—	0.8 (0.8)	1.7 (0.1)	0.7 (1.0)	—	—	0.7 (0.7)	5.2 (1.0)	1.6 (0.0)	0.7 (0.0)	—	0.5 (0.1)	0.480	0.240	0.030*
C16:0	22.5^{abc} (0.0)	22.8^{abc} (3.3)	20.1^{abc} (0.3)	30.0^{c} (3.9)	25.7^{bc} (0.8)	13.6^{a} (2.6)	17.0^{ab} (1.0)	20.1^{abc} (2.5)	21.9^{abc} (0.1)	16.7^{ab} (0.5)	18.0^{ab} (0.6)	20.8^{abc} (1.5)	0.001*	0.004*	0.043*
C18:0	18.8^{ef} (0.1)	15.7^{def} (5.1)	2.5^{a} (1.0)	3.4^{ab} (0.2)	27.0^{f} (0.8)	13.6^{cde} (2.6)	8.4^{abcde} (0.1)	10.1^{bcde} (1.5)	8.1^{abcd} (0.1)	5.9^{abc} (0.2)	9.0^{abcde} (0.2)	4.4^{ab} (1.3)	<0.001*	<0.001*	0.001*
C22:0	7.3^{bcd} (0.0)	1.6^{a} (1.6)	0.7^{a} (0.1)	-	15.4^{d} (0.5)	8.5^{cd} (1.0)	1.7^{ab} (0.1)	-	1.2^{a} (0.0)	2.0^{abc} (0.1)	3.7^{abc} (0.0)	2.6^{abc} (0.3)	0.003*	<0.001*	0.001*
∑ SFA	48.7^{ab} (0.1)	49.6^{ab} (8.9)	38.6^{a} (1.1)	41.5^{a} (0.5)	68.1^{b} (2.1)	66.8^{b} (4.8)	46.6^{ab} (1.0)	90.5^{c} (5.0)	37.0^{a} (1.0)	45.5^{ab} (2.4)	60.6^{ab} (0.2)	37.9^{a} (4.9)	0.060	<0.001*	<0.001*
C16:1ω7	2.7^{abc} (0.0)	9.1^{cd} (2.0)	21.3^{d} (2.2)	5.9^{bc} (0.3)	2.5^{abc} (0.1)	4.0^{abc} (0.9)	3.8^{abc} (2.7)	3.6^{abc} (0.2)	3.9^{abc} (0.0)	0.6^{ab} (0.0)	0.7^{a} (0.7)	0.3^{a} (0.3)	0.050	<0.001*	0.001*
∑ MUFA	16.8^{abcd} (0.1)	25.1^{cd} (1.6)	31.9^{d} (1.9)	14.0^{abc} (0.7)	15.5^{abc} (1.1)	19.1^{bcd} (3.4)	16.7^{abcd} (2.1)	6.5^{a} (3.1)	23.6^{cd} (0.8)	16.8^{abcd} (2.9)	7.5^{ab} (0.4)	28.3^{cd} (2.5)	0.139	0.003*	<0.001*
C18:2ω6	10.9^{bcde} (0.0)	5.2^{abc} (4.4)	4.3^{abc} (1.7)	0.7^{a} (1.1)	15.6^{cde} (1.0)	7.5^{abcd} (1.7)	13.6^{cde} (0.6)	1.1^{ab} (0.0)	28.7^{e} (0.1)	22.3^{de} (0.4)	7.0^{abcd} (0.4)	25.1^{e} (2.5)	<0.001*	<0.001*	0.002*
C18:3ω3	6.6^{cd} (0.1)	1.5^{ab} (1.1)	3.5^{bc} (0.3)	10.1^{d} (0.6)	—	—	2.4^{bc} (0.3)	0.2^{a} (0.2)	0.8^{ab} (0.0)	1.2^{ab} (0.3)	—	0.8^{ab} (0.3)	0.030*	<0.001*	<0.001*
C18:3ω6	—	2.5^{bc} (0.2)	2.9^{bc} (0.2)	9.5^{d} (0.5)	—	0.5^{a} (0.5)	1.9^{ab} (0.1)	-	6.4^{cd} (0.0)	6.4^{cd} (0.1)	1.2^{ab} (0.0)	—	<0.001*	0.002*	<0.001*
C20:4ω6	6.9^{c} (0.0)	0.2^{a} (0.2)	1.7^{abc} (0.5)	0.1^{a} (0.1)	—	—	4.2^{bc} (0.1)	0.9^{ab} (0.9)	0.5^{ab} (0.0)	—	6.4^{c} (0.0)	0.2^{a} (0.2)	<0.001*	0.369	0.002*
C20:5ω3	6.5^{abc} (0.1)	10.2^{bc} (3.2)	12.1^{c} (0.8)	16.6^{c} (0.5)	—	0.2^{a} (0.2)	9.9^{bc} (0.0)	0.3^{a} (0.3)	—	1.7^{ab} (1.7)	—	0.4^{a} (0.4)	0.014*	<0.001*	0.012*
C22:6ω3	3.6^{bc} (0.0)	2.8^{bc} (0.8)	4.1^{bcd} (0.2)	5.7^{cd} (0.1)	—	1.5^{ab} (0.3)	3.4^{bc} (0.0)	0.3^{a} (0.3)	—	2.0^{abc} (0.1)	9.0^{d} (0.5)	2.7^{bc} (1.4)	0.001*	<0.001*	0.002*
∑ PUFA	34.5^{de} (0.3)	25.4^{bcd} (8.5)	29.6^{bcde} (0.8)	44.5^{e} (1.2)	15.6^{bc} (1.0)	14.1^{b} (1.4)	36.7^{de} (1.0)	3.0^{a} (1.9)	39.2^{de} (0.2)	37.7^{de} (0.6)	31.9^{cde} (0.3)	33.8^{de} (2.4)	0.015*	<0.001*	<0.001*
ω3:ω6 ratio	0.9^{bcd} (0.0)	1.4^{cde} (0.1)	2.2^{de} (0.6)	2.8^{e} (0.5)	—	0.2^{ab} (0.0)	0.8^{bcd} (0.1)	0.2^{ab} (0.2)	0.0^{a} (0.0)	0.2^{ab} (0.1)	0.5^{abc} (0.0)	0.1^{ab} (0.1)	0.003*	<0.001*	0.100

Means followed by the different superscript letters are significantly different ($P < 0.05$, one-way ANOVA with Tukey post hoc test) on each row. —, not detected. Asterisks indicate significance at $P < 0.05$.

Supplementary references

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