TABLE 4

Detoxification of PSP toxins by various bivalve species (adults unless indicated), classified as relatively fast (A) and slow (B) detoxifiers, as measured by the time required to achieve the regulatory level (RL, 80 μg STXeq 100 g^{-1}), and detoxification rate (% loss of toxin day^{-1}), calculated from an exponential decay equation: $T_t = T_o e^{-\lambda t}$ fitted to empirical data (T = toxicity; t = detoxification time). Detoxification determined for whole tissues and toxicity determined by mouse bioassay unless specified

Species	Peak toxicity[d] (μg STXeq 100 g^{-1})	Time to RL (weeks)[b]	Detox. rate (% day^{-1})	Location/detoxification conditions	Source
(A) Fast Detoxifiers:					
Tresus capax	3520	$5.2 < t < 11.6$[e]	—	Theodosia Inlet, BC, Canada	Quayle (1969)
Mercenaria mercenaria	2150[a] (GtLl22)	>3.6 (3.4)	9.5	Laboratory, 17°C, fed	Bricelj et al. (1991)
	10543[b] (GtCA29)	>2.6 (6.1)	>0.8 d = 9.3[c]	juveniles	
Meretrix casta	3787	4.4	—	Kumble estuary, India	Karunasagar et al. (1984)
Mya arenaria	110–1425	1.0 – 4.0	9.8	Maine, USA (fall)	Hurst and Gilfillan (1977)
	200–1200	7.1 – 5.0	—	Gulf St. Lawrence, floats, 4 –17°C	Larocque and Cembella (1991)
	~ 270–470	3.3 – 4.0	—	Bay of Fundy, Canada	Prakash et al. (1971)
	864	<4.0	—	Theodosia Inlet, BC, Canada	Quayle (1969)
	~ 840	4.7	7.7	Franquelin, St. Lawrence estuary, Canada	Cembella et al. (1988)
Mytilus edulis	2720 (MOG835)	7.9	5.9	Laboratory, 16°C, fed	Lassus et al. (1989)
	2371 (MOG835)	>2.9 (3.1)	14.2	Laboratory, 16°C, fed	Lassus et al. (1993)
	17490	$12.5 < t < 15.6$[e]	—	Nordasstraumen, Norway	Alvik and Framstad (1981)
		>12.6 (7.6)	9.7	Transferred to toxin-free area	"
	19259[a] (GtCA29)	> 5.7 (7.7)	8.9	Laboratory, 17°C	Bricelj, Lee and Cembella, unpublished
	137–1039	1.0 – 4.8	$\bar{X}$ = 15.4	Maine, USA (spring)	Hurst and Gilfillan (1977)
	1575–11180	2.7 – 6.8	$\bar{X}$ = 15.4	Maine, USA (fall)	
	1407–3857	2.9 – 6.0	$\bar{X}$ = 4.8	Spurwink River, Maine, USA	ME Dept. Mar .Res.,
	100–798	0.6 – 4.8	$\bar{X}$ = 5.8		1979 to 1993 records
	1367–9075	2.1 – 9.6	$\bar{X}$ = 12.1	Lumbos Hole, Maine, USA	
	4100	3.0	—	Santa Barbera Channel, California, USA	Price et al. (1991)
	~1100	6.1	—	Bay of Fundy, Canada 10 – 11°C	Prakash et al. (1971)
	23000	5.1	13.8	Gaspé Bay, Canada	Desbiens and Cembella (1993)
	~2000	2.1	—	Outdoor tanks, no toxic cells	Oshima et al. (1982)

TABLE 4 (continued)

Detoxification of PSP toxins by various bivalve species (adults unless indicated), classified as relatively fast (A) and slow (B) detoxifiers, as measured by the time required to achieve the regulatory level (RL, 80 μg STXeq 100 g^{-1}), and detoxification rate (% loss of toxin day^{-1}), calculated from an exponential decay equation: $T_t = T_o e^{-\lambda t}$ fitted to empirical data (T = toxicity; t = detoxification time). Detoxification determined for whole tissues and toxicity determined by mouse bioassay unless specified

Species	Peak toxicity[d] (μg STXeq 100 g^{-1})	Time to RL (weeks)[b]	Detox. rate (% day^{-1})	Location/detoxification conditions	Source
Mytilus californianus	2100–5300	6.8 – 7.5	$\bar{X}$ = 8.9	BC, Canada	DFO 1992 records
	900–1900	2.8 – 6.4	$\bar{X}$ = 8.1		
	240–790	3.0 – 9.0	$\bar{X}$ = 5.3		
	1100–1456	3.1 – 3.4	$\bar{X}$ = 8.1	Sequim Bay, WA, USA, floats, 13–16°C	Sribhibhadh (1963)
	685–768	3.2 – 8.9	$\bar{X}$ = 6.6	Clallam Bay, WA, USA, floats, 9–11°C	
	353–444	3.8 – 3.9	$\bar{X}$ = 5.1	Crescent Bay/Agate Beach, USA, floats, 11–13°C	
Choromytilus palliopunctatus	540	1.2 < t < 7.0[e] (1.4)	17.2	Oaxaca, Mexico	Cortés-Altamirano et al. (1993)
Perna viridis	~240*	1.7	9.3	Laboratory, fed, 26–28°C	Gacutan et al. (1989)
Modiolus modiolus	—	0.9 – 9.2	$\bar{X}$ = 7.0	Maine, USA	Hurst and Gilfillan (1977)
Crassostrea gigas	209–379	0.6 – 1.5	—	Juan de Fuca St., WA, USA floats, 12–15°C	Sribhibhadh (1963)
	710	2.0	—	San Mateo Bay, BC, Canada	DFO 1987
Crassostrea iridescens	~620–810	1.8 – 3.8	8.9 – 18.1	Oaxaca, Mexico	Cortés-Altamirano et al. (1993)
Crassostrea cucullata	1336*	6.9	5.5	Kumble estuary, India	Karunasagar et al. (1984)
Ostrea edulis	1000	6.4	4.0	Harpswell, Maine, USA	Shumway et al. (1990)
Pecten maximus	2700	>6.3 (6.4)	7.4	Laboratory, 16°C, fed	Lassus et al. (1989)
(B) Slow Detoxifiers:					
Saxidomus giganteus	8640	>90[c] (159)	< 83 d = 1.2[c] > 83 d = 0.3	Theodosia Inlet, BC, Canada	Quayle (1969)
	3174	114[c] (111)	> 47 d = 0.6[c]	Little River, BC, Canada	
	278	>14	—	Laboratory, 7.5–16.5°C, fed	Madenwald (1985)
Saxidomus nuttalli	14000	>73 (85)	0.9	Bodega Harbor, CA, USA	Price et al. (1991)
	2800 (Siphon)	>42 (118)	0.4		
	620 (Siphon)	39 (40)	0.8		
Spisula solidissima	30429[a] (PR18B)	> 8 (24)	3.4	Laboratory, fed, juveniles 16–17°C	Bricelj, Laby and Cembella, unpublished
	16810[a] (AL1V)	> 9[c](13)	< 6 d = 24.3[c] > 6 d = 4.2	Laboratory, fed, juveniles 16°C	Bricelj and Cembella (1995) and unpublished

	4514	100[c] (81)	< 32d = 1.9[c] > 32 d = 0.5	Head Beach, ME, USA ME Dept. Mar. Res.	Shumway et al. (1988) and
	1752	96 (59)	0.8	Scarborough Beach, ME, USA	
	6000	> 100 (48) (132)[c]	1.3 < 42d = 1.2[c] > 42 d = 0.4	Georges Bank, USA, Station 3	Shumway et al. (1994)
	3900	>69[c](73)	< 30d = 1.6[c] > 30 d = 0.6	Georges Bank, USA, Station 1	
	4010–4510	> 70 (51)	1.1	Georges Bank, USA, St. 2 & 4	
	1705	> 26	—	Laboratory, 15°C, 20 μm-filtered ambient water	
	1140 (Viscera) 1624 (Mantle)	> 13	—	Laboratory, fed	Blogoslawski and Stewart (1978)
Cardium edule	3100*	11.2	3.3	Lagune d'Óbidos, Portugal 11–15°C	De Sousa and Silva (1963)
Soletellina diphos	40000 (Dig.)*	> 51[c](31)	<14 d = 3.6[c] >14 d = 1.2	Culture pond, Tungkang, Taiwan	Hwang et al. (1990)
Placopecten magellanicus	~1674 (Dig.+Mantle+Gill)	> 28 (78)	0.6	Laboratory, starved	Shumway et al. (1988)
	809 (–Adductors)	> 52 (135)	0.2	Laboratory, –0.2 to +14°C	Waiwood et al. (1995)
	6179 (Dig.)	> 52 (104)	0.6		
	2720 (Dig.)	> 17	—	Mascarene, Bay of Fundy,	Bourne (1965)
	1440 (Mantle)	> 17	—	Canada	
	4000 (Dig.)	> 8.7	—	Whitehouse, Bay of Fundy	
	1248	> 8.7	—	Canada	
Patinopecten yessoensis	15000 (Dig.)*	> 30 (60)	1.2	Funka Bay, Japan	Nishihama (1980) (Figure 4)
	~ 11000 (Dig.)*	> 16.7 (31)	2.2	Funka Bay, Japan, 10 m	Nishihama (1980) (Figure 10)
	~11100 (Dig.)*	>12 (10)	2.5	Funka Bay, Japan, 25 m	
	6380 (Dig.)*	~ 24 (38)	1.6	Funka Bay, Japan, 1981	Tazawa et al. (1988)
	7920 (Dig.)*	23 (16)	4.1	Funka Bay, Japan, 1986	
	10880 (Dig.)*	> 27 (22)	3.1	Funka Bay, Japan, 1984	
	6000 (Dig.)*	> 19 (15)	3.8	Ofunato Bay, Japan	Ogata et al. (1982)
	14500 (Dig.)*	> 17	—	Ofunato Bay, Japan	
	340000 (Dig.)*	> 21[c](20)	< 8 d = 11.7[c] > 8 d = 1.3	Outdoor tanks, no toxic cells	Oshima et al. (1982)

[a] *Toxicity determined by HPLC.*
[b] *obtained by linear interpolation from empirical data; value in brackets calculated from a fitted exponential decay equation.*
[c] *Calculated assuming a biphasic detoxification pattern, with initial linear toxin loss and subsequent exponential loss.*
[d] *Where a range is reported, values correspond to different locations or years; the dinoflagellate isolate used in laboratory toxification studies is indicated in brackets.*
[*] *Calculated using a conversion factor of 0.2 μg STXeq MU^{-1}.*
[e] *Sampling interval too large to allow interpolation.*