## シロボヤの季節的消長

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## Seasonal Settlements of Styela plicata (LESUEUR)

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Seasonal settlements of *Styela plicata* (L<sub>ESUEUR</sub>) on the exposed test nets were observed from 1958 to 1960 at Sakibe Inlet in Sasebo Bay.

- 1. Styela has a long spawning period extending from the late spring to the early winter with two peaks at the early summer and the autumn.
- 2. Main spawning group in autumn is assumed to be consisted of the early summer attaching generation in same year, and the autumn generation will grow to the main spawning group of the next early summer.
- 3. The growth rates of the early summer generation were greater than the autumn, but the former's standing crops were less than the latter's.
- 4. The good attachment and growth of Styela occur, in general, at depths below 2 meters.

シロボヤは世界の温水域に広く分布しており、これは船舶によったものと考えられている。<sup>1)</sup> 我国では本州、四国、九州の沿岸にみられる。 この筋膜体は食用として利用されるが一般的でなく、 むしろ沿岸域の養殖業者は汚染生物としてその防除に腐心している。

九州西海域にある佐世保湾では、分布の中心域は外湾水の影響のやや弱い中間水帯にある。 筆者はかかる 水帯に位置する一枝湾である崎辺浦で1958年より1960年にかけて本種の生態を観察したが、その中の付着期 及び付着量の季節的変動についてここに報告する。

#### 実験方法

崎辺浦(水深10m)に小型の筏を設置し、これに付着基盤用の網を垂下して浸漬後1ヵ月, 2ヵ月, 3ヵ 月目にとりあげ,付着した個体数を数え,体長,体幅及び体重を測定した。網の交換は月の中旬に行った。 ここでは漬浸期間が1ヵ月,2ヵ月,3ヵ月の網を1ヵ月網2ヵ月網,3ヵ月網とよぶことにする。網はク レモナ9本7節のものを10×10目に切り,竹とシュロ綱で構成した梯子状の枠に1m間隔にとりつけ,各網 は水深0-1,2-3,4-5,6-7mの間に位置するようにした。かかる装置及び方法はこの水域で行 った付着生物の調査に使用したものと同一である。<sup>2)</sup>

#### 結 果

1. 付着期 1ヵ月網に付着している個体は明らかに付着してから1ヵ月以内である。実験期間中の 付着1ヵ月以内の個体はすべて5mm以下の体長であった。2ヵ月網、3ヵ月網の5mm以下の個体も揚網日か ら1ヵ月以内に付着したものといえる。それ故に5mm以下の個体数の月変動は本種の付着期を示す。'58年6 月より'60年8月までの各浸漬網について水深別に各月の体長5mm以下の個体数を整理して示したのがTable1 である。

この表の'59年の例でみると、付着期は晩春から初冬までの長期間である。ただし夏期7~8月には1カ月 網への付着はなく、2~3月網への付着数も僅少である。また1月以降の冬期には1カ月網には付着がない し、2~3カ月網でも2月と3月には付着はほとんどない。水温の高い夏期は産卵数の減少と付着に不利な 環境による付着の衰退期とみられる。また冬期の低水温期は産卵も行われず、付着にも最も悪い環境条件の 時と推察される。'58年は台風のため秋の資料がないが、変動の傾向は'59年と一致している。しかし付着数 や山の出現月等には多少の違いがある。

この3カ年の傾向から本種の付着期は冬期を除く長期間に亘ること, さらに初夏(5~6月)と秋(10~ 11月)の年2回の盛期があることが推定される。 ここでは初夏の付着群を初夏世代, 秋のを秋世代と呼ぶこ とにする。 Table 1 から秋世代が初夏世代よりも付着期間が長く付着数も大であり, しかも年変動も大きい ことがうかがわれる。 しかし同じ年でも付着基盤の種類や浸漬期間が異なると, 各世代の付着の様相はかな り違ってくる。<sup>3)</sup>

さらに Table 1 で特徴的なことは、2~3カ月網では1カ月網よりも付着期が長くなり、また付着数が大 きくなっていることである。 このことは古い浸漬物が付着に好条件であること、 すでに付着した生物により 付着面が拡大されていること 等によるものと考えられる。 しかし浸漬期間がある程度以上長くなると付着数 が減少している現象もみられる。'59年の秋から冬にかけては3カ月網の付着数は2カ月網よりも少くなって いる。 これは先着の生物による基盤の占領と、 これらによって浮游幼生が捕食されるためと考えられる。そ の他にもいろいろ原因があると思われるが、 浸漬期間が長くなるとこれらの 諸作用がか らみあって複雑な様 相を呈するのであろう。上述の'59年の例では、2カ月網では付着を助長する作用が1カ月網よりも大きく、 3カ月網では助長作用は 1カ月網よりも大であったが阻止の作用が2カ月網よりも大きくなり、 付着数は1 カ月網よりも多いが2カ月網よりは少くなったものとも考えられる。

**2** 付着に好適な水深層 付着数の多い 水深層は月により異なるが, 同月の各網の水深別の変動はほぼ 同一の傾向をみせている。 '59年には盛期の最大付着層は 0-1m(2-3カ月網)か2-3m層(1カ月 網)であるが, 盛期の前後では中層から下層が多くなっている。 '58年と60年では盛期にもこの層は2-3m 層以深となっている。 しかし付着に好適な水深層を周年的な観点からみれば, 付着数よりもむしろ付着した 月の頻度をとるのが妥当である。この点からするとこの層は2m以深にあるといえる。

筆者の室内でのふ化飼育によると(4-5月,水温19~20°C),90%近くの幼生は表層に浮上し器壁の表 層部に付着し、幼生は反走地性を示すものとみられた。海中でも幼生のかかる運動が認められるとしても、 沿岸域の表層は降水や気温等の影響で環境条件の変化が大きいので、これが表層の付着数の変動を大きくし ているのであろう。周年的に中層以深の環境条件が表層に比して安定していることが付着の好適層が2m以 深となっていることの最大要因であると考える。

3 産卵期 本種の産卵期については、米国では6~9月とされている。() 我国では、平井<sup>6)</sup>が6月 に室内の自然放卵のもので、水温19~20°Cで放卵後約12時間で tadpole 幼生になるのを観察し、この実験 から本種の産卵期は初夏であるとしている。 筆者は崎辺浦及び長崎港の材料で4~5月と10月に水槽内(水 温19~22°C)で放卵を行わせ、付着は放卵後2昼夜以内に行われることを観察した。放卵から付着までの時 間が短いので、付着期は産卵期とみなしてよいであろう。

上記の放卵実験で産卵個体の最小は体長30~35m, 体重10~15 g であった。この大きさには付着後3~4 カ月で達する。また本種の寿命は約1年である。<sup>6</sup>)これらより初夏世代は同年の秋と翌年の初夏の2回, 秋 世代は翌年の初夏と秋の2回に産卵を行うものと推察される。しかし初夏世代群は翌年の5~6月に, 秋世 代群は翌年の8~9月に死滅期がある。<sup>6</sup>)それ故,初夏世代群は同年の秋の主産卵群となり,翌年には初夏 盛期の前期(4~5月)には産卵を行うが、5~6月には死滅期に入るので初夏盛期には生残りの少数個体 が産卵し,この期の産卵主群は前年の秋世代群になると思われる。この秋世代群は8~9月に大部分が死滅 するので,秋の主産卵群は同年の初夏世代群ということになる。

卵数と付着数の関係については資料はないが、付着数を左右する最大の要因は、 卵数よりも付着基盤の大 きさや質及び環境条件であろう。

**4** 付着総量 一般に付着生物は基盤の大きさにより付着数は制限されるが,付着は最初は平面的であるが後には立体的にも行われるようになる。立体的に付着する場合,フジツボやカンザシゴカイの如く死殻

の残るものでは上部への付着が数段にも及ぶが、シロボヤの如く死後分解する種類では、上部への付着は下 部の個体が生存できる範囲でしか付着は行われない。シロボヤの上にシロボヤが付着し、この構造が保持さ れるためには下部個体の生活の充分保証された構造であることが必要である。一般にこの場合、2段付着が 普通で3段以上の付着はほとんどみられない。またシロボヤを優占種とする水域では、シロボヤの上の他の 付着生物(フサコケムシ、カンザシゴカイ等)の繁茂と衰退が本種のそれと同調してみられる。付着構造や 同種間及び種間の相互作用は数の変動を取扱う際には重要な要因となるが、一般にこれらの作用が大きく影 響するのは半年以上の浸漬物においてである。ここで取扱った3カ月以内の浸漬網にはこれらの作用は顕著 にはみられなかった。

i) 付着量, 増加率及び増重率 各月の1~3カ月網に付着したシロボヤの総重量と総個体数を水深別 に Table 2 に示す。1カ月網の付着個体は5 mm以下の体長であるが、2カ月網では最大個体は50 mm, 3カ月 網では60 mmであった。1カ月網の付着数や重量の変動は新個体のそれと一致しているが、2~3カ月網では 付着後の生育期間が1乃至2カ月間あるので, 重量が最大となっているのは付着盛期から1~2カ月後とな る。すなわち'59年の秋では, 盛期が10~11月であるので3カ月網では'60年1月に最大重量となっている。

網に付着したシロボヤ群の個体数の増加率と増重率を付着世代別に示したのが Table 3 である。この表では '58年から'60年までの資料を一しょにして計算してある。 これでみると、 1ヵ月から2ヵ月にかけての増

Season	May	-Aug.	SeptFeb.					
	Ind. no.	Weight	Ind. no.	Weight				
2 months exp. net 1 month exp. net	65.2	315.8	3.2	23.8				
3 months exp. net 2 months exp. net	1.6	15.8	1.1	10.2				

Table 3 Growth rates of number and weight by each attaching generation in *Styela* population attached on the exposed nets

加率及び増重率は2カ月から3カ月への率より大きくなっており、2カ月以後は個体数はほとんど増加せず 重量のみが増加していることがわかる。一定面積の基盤上にシロボヤが付着する場合、個体数の増加は浸漬 後2カ月以内で、それ以後の群の増大は重量の増加(生長)によっているものといえる。

初夏世代と秋世代では増加率, 増重率ともに前者が大きい。しかし付着現在量は秋世代群が初夏世代群より数十倍大きかった(Table 2)。

ii) 好生育水深層 付着後3カ月以内の期間について生育の良好な水深層を求める。 この際に付着数は 新個体の付着期間が長期で多くの月にこれらの付着があるので, 群の生育の計測値としては適当ではない。 既述の如く群の増大は重量によくあらわれているので, 生育の好適水深は2~3カ月網の重量の大きい水深 層と考えてよいであろう。 これらの網の合計重量は2カ月網では2~3m層が最大で次いで4~5m層とな る。 3カ月網では大きい層の順からは4~5,6~7,2~3mとなる。両者網の0~1m層の重量は他の 層の½~¼となっている。すなわち生育に好適な水深は2m以深である。 好適付着層と同様に,環境条件の 比較的に安定している層が生育にもよい層だといえる。 さらに重量の最も大きい水深を生育の最適層とみな すと,3カ月網では2カ月網よりこの層がやや深くなっている。生育期間が進むと僅かながらも好生育層が 深くなることを示しているとも考えられるが,詳しくはより長期の浸漬実験をまたねばならぬ。

#### 要 約

佐世保湾崎辺浦で1958年から1960年に網に付着したシロボヤの季節消長を観察した。

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- 1. 付着期は晩春より初冬までの長期間であり、盛期は初夏と秋にある。
- 2. 初夏付着世代群は同年の秋の主産卵群となり、秋世代群は翌年の初夏の主産卵群になるものと推察される。
- 3. 付着数及び重量は秋世代が初夏世代よりも大きいが、群の増加率及び増重率は逆であった。
- 4. 付着及び付着後の生育に好適な水深層は2m以深である。

終りに, 種々な教示と原稿の校閲をしていただいた本学部の山田鉄雄教授に対し, また本種の生態や文献 について教示をいただいた京大瀬戸臨海実験所の時間隆博士に対し厚く感謝する。

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Exposed duration	Month Depth m	'58 VI	VII	VIII	IX	x	XI	XII	′59 I	П	ш	IV	v	VI	VII	VIII	IX	x	XI	XII	'60 I	П	III	IV	v	VI	VII	VIII	Total
	0-1	-	-	_	*		3							_	-	—		3	60						·			-	66
<i>,</i>	2 - 3		-			3	8		-	-	-	-		4	-	-		9	1,246	15	<u>-</u>		-	-		1	1		1,287
l-Month	4 - 5	-				4	21					-				_	9	21	516	12				-		_			583
	6 - 7	·		-		1	24					-	_		_	_	10	36	246	10	-			_		—	-	1	328
	Total					8	56	-	_	-		-	-	4	_		19	69	2,068	37	·		_			1	1	1	2,264
	0 - 1	17			*	*	11	25			13			73	_	1		_	1,700	235						6	]		2,082
	2 - 3	_		40			11	68	17		_			52	1	1	124	95	483	436		-		_	g	8	2	- 1	1,342
2-Months	4 - 5	4	-	5			7	93	45	_	-	_		7	Z		220	20	561	376	<del>.</del>			-	10	8	-		1,358
	6 - 7	_	-	25			66	244	58	_	-		9	36	3		-	12	443	261			-		6	13		·	1,178
	Total	21	_	70			95	430	120		13	_	g	168	6	2	344	127	3,187	1,308	_		-	-	27	35	3	3	5,960
·	0-1	9	e		*	*	*	12	86	_		_		39	2			567	300	3						6		-	1,030
	2 - 3	6		9				140	42		-			38	1	5		377	112	20				_	10	18	נ		781
3-Months	4 - 5	-		17				143	147	61			1	28	1	100	86	288	87	30	Э				10	7	—		1,009
	6 - 7	-						240	176	81	14		21	27		18	1	76	63	45	ε	, <u> </u>			10	2	-	-	782
	Total	15	-	26				535	451	142	14	_	22	132	4	123	87	1,310	562	98	11				30	33	]		3,602

# Table 1Monthly individual numbers of Styela in body length less than 5 mm attached on the test nets\*:no sample

Exposed duration	Month Depth m	'58 VI	VI	VIII	IX	x	x	XII	'59 I	п	THE L	IV	v	VI	VII	VII	IX	х	XI	XII	'60 I	п	Ш	IV	v	VI	VII	MI	Total weight	Total ind. no.
	01				*	•	0.2					-				_		0.2	3.5 (60)	·						_	_	_	3.9	66
	2 - 3					0.2	2 0.4		_			-		0.2 (4)				(0,4 (9)	10.7 (1,246)	0.4 (15)	. —					0.1 (1)	0.1 (1)		12.5	1,287
1-Month	4 - 5					0.2 (4)	2 1.3 (21)									·	0.4 (9)	1.4 $(21)$	8.6 (516)	0.6 (12)					_	_	_		12.5	583
	6 - 7	_				0.1 (1)	1.4 (24)										0.5 (10)	2.4 (36)	6.9 (246)	0.5 (10)				·				0.1 (1)	11.9	328
	Total	-				0.1	5 3.3 ) (56)							0.2 (4)			0.9 (19)	4.4 (69)	29.7 (2,068)	1.5 (37)						0.1 (1)	0.1 (1)	0.1 (1)	40.8	2,266
	0 - 1	1.1		14.2 (5)	*	* *	0.6 (11)	1.6 (25)			0.7 (13)		_	5.8 (87)	1.1 (2)	16.6 (11)		3.2 (5)	23.2 (1,710)	29.0 (256)		_				0.8 (8)	0.3 (2)		98.2	2,152
	2 - 3			4.1 (45)			0.7	13.9 (116)	1.1 (17)					61.1 (85)	0.1 (1)	13.8 (9)	6.8 (125)	13.0 (105)	61.3 (564)	309.5 (1.036)					0.2 (9)	1.3 (13)	15.3 (9)	26.4 (7)	483.6	2,173
2-Months	4 - 5	0.2 (4)		0.3 (5)			0.8 (13)	7.4 (112)	5.4 (63)			-		8.3 (50)	1.0 (4)		6.7 (220)	1.3 (20)	30.4 (593)	261.7 (703)		_	_		0.1 (10)	2.0 (18)	17.5 (5)	0.3 (1)	343.4	1,820
	6 - 7	-		2.7 (36)			3.8 (66)	10.3 (265)	4.1 (63)				0.5 (9)	11.7 (75)	3.4 (6)		·	0.7 (12)	36.6 (485)	122.5 (555)		-	_		0.4 (8)	2.4 (17)	9.0 (7)	3.5 (3)	211.6	1,607
	Total	1.3 (21)		21.3 (91)			5.9 (102)	33.2 (518)	10.6 (143)		0.7 (13)		0.5 (9)	41.9 (297)	5.6 (13)	30.4 (20)	13.5 (345)	18.2 (142)	151.5 (3,354)	722.7 (2.567)	-				0.7 (27)	6.5 (56)	42.1 (23)	30.2 (11)	1,136.8	7,752
<u> </u>	0 - 1	2.9 (27)	27.2 (4)	0.2 (1)	1	• +	*	15.7 (27)	4.4 (86)	_	-	_	_	3.6 (45)	61.9 (17)	22.3 (11)	_	4.4 (7)	83.3 (713)	572.2 (632)	119.6 (66)		_			20.4 (20)	41.6 (10)	2.4 (1)	982.1	1,667
2-Months	2 - 3	0.3 (6)	1.3 (6)	9.0 (13)			_	13.5 (163)	45.5 (101)		-	-	·	20.0 (73)	192.3 (20)	157.3 (18)	60.9 (21)	89.8 (32)	111.0 (469)	749.3 (632)	1,290.0 (300)	-			0.5 (10)	52.8 (47)	186.3 (26)	101.8 (14)	3,081.6	1,951
	4 - 5	_	2.2 (6)	8.0 (25)				10.0 (171)	227.4 (318)	20.1 (127)		-	0.1 (1)	10.2 (58)	161.2 (18)	57.2 (6)	82.3 (112)	32.8 (209)	84.9 (324)	667.2 (462)	2,532.0 (615)	2.2 (17)			0.5 (10)	66.7 (39)	374.8 (46)	52.9 (5)	4,392.7	2 <b>,</b> 569
	6 - 7	1.5 (10)	3.2 (6)					9.9 (258)	123.9 (355)	11.4 (94)	0.9 (14)		1.4 (21)	7.3 (57)	191.7 (30)	141.8 (19)	9.1 (24)	30.3 (10)	204.8 (147)	317.4 (174)	2,217.0 (840)	9.6 (50)			0.7 (12)	54.3 (35)	458.4 (51)	63.2 (5)	3,857.8	2,212
	Total	18.2 (43)	33.9 (22)	17.2 (39)			-	49.1 (619)	401.2 (860)	31.5 (221)	0.9 (14)		1.5 (22)	41.1 (233)	607.1 (85)	378.6 (54)	152.3 (157)	157.3 (258)	484.0 (1,653)	2,306.1 (1,900)	6,158.6 (1.821)	11.8 (67)			1.7 (32)	194.2 (141)	1,061.1 (133)	220.3 (25)	12,314.2	8,399

# Table 2 Monthly changes in wet weight (g) and number (in the brackets) of Styela attached on the test nets \*:no sample

## ERRATA

### (English only)

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