

Abstract—Light traps and channel nets are fixed-position devices that involve active and passive sampling, respectively, in the collection of settlement-stage larvae of coral-reef fishes. We compared the abundance, taxonomic composition, and size of such larvae caught by each device deployed simultaneously near two sites that differed substantially in current velocity. Light traps were more selective taxonomically, and the two sampling devices differed significantly in the abundance but not size of taxa caught. Most importantly, light traps and channel nets differed greatly in their catch efficiency between sites: light traps were ineffective in collecting larvae at the relatively high-current site, and channel nets were less efficient in collecting larvae at the low-current site. Use of only one of these sampling methods would clearly result in biased and inaccurate estimates of the spatial variation in larval abundance among locations that differ in current velocity. When selecting a larval sampling device, one must consider not only how well a particular taxon may be represented, but also the environmental conditions under which the device will be deployed.

Current velocity and catch efficiency in sampling settlement-stage larvae of coral-reef fishes

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With few exceptions, benthic marine organisms exhibit a complex life cycle in which larvae are dispersed pelagically and undergo a planktonic existence before they settle to the sea floor. The vagaries of dispersal by currents and unpredictable mortality of larvae in the plankton contribute to tremendous variation observed in recruitment (here defined broadly as the input of young) to adult populations. For reef fishes, the relative importance of variation in the supply of settlement-stage larvae versus postsettlement density-dependent mortality of recruits to the size and structure of local populations has been debated for some time, with evidence provided for both points of view (Doherty and Williams, 1988; Doherty, 1991; Hixon, 1991; Jones, 1991; Doherty and Fowler, 1994; Hixon and Carr, 1997; Schmitt and Holbrook, 1999). In order to determine the relative contributions of presettlement and postsettlement processes to the population dynamics of reef fishes, knowledge of spatial and temporal variation in the delivery of settlement-stage larvae to local populations is essential.

Various methods have been employed to assess the local abundance of pelagic larvae and juveniles of coral-reef fishes

(Choat et al., 1993, and references therein). Two common but relatively recent sampling devices developed to sample settlement-stage reef fish larvae are light traps (Doherty 1987; Thorrold and Milicich 1990; Milicich et al. 1992; Thorrold, 1992; Meekan et al., 1993; Thorrold, 1993; Milicich and Doherty, 1994; Doherty et al., 1996; Sponaugle and Cowen, 1996a, 1996b; Thorrold and Williams, 1996; Doherty and Carleton, 1997; Sponaugle and Cowen, 1997; Leis et al., 1998; Munday et al. 1998; Meekan et al. 2000) and stationary nets, including channel nets (Shenker et al., 1993; Thorrold et al., 1994a, 1994b, 1994c) and crest nets (Dufour and Galzin, 1993; Dufour et al., 1996). Light traps are active sampling devices in that fish are attracted to, swim towards, and enter a transparent or semitransparent trap with a light source. By contrast, channel nets and crest nets passively catch larvae that are carried into them by currents or wave action, respectively. Unlike a previous study that compared light traps with towed nets (Choat et al., 1993), the goal of this study was to compare light traps and fixed-position nets, two commonly used methods for collecting settlement-stage fish larvae near coral reefs.

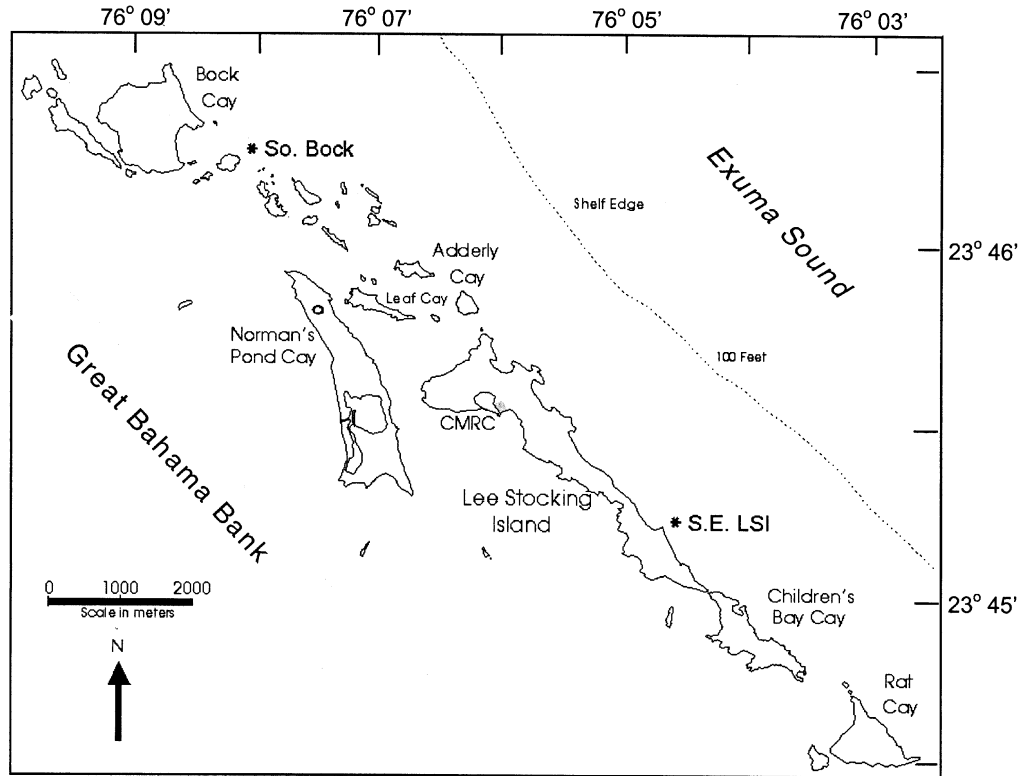


Figure 1

Location of South Bock Cay (So. Bock) and southeast Lee Stocking Island (S.E. LSI) study sites near the Caribbean Marine Research Center (CMRC), Lee Stocking Island, Bahamas.

Light traps and channel nets may not only differ in capture success for any particular species, but in the collection of larvae under varying environmental conditions such as current velocity and turbidity. Species (and the ontogenetic stages of these species) can differ in their sensitivity to light cues (Doherty, 1987; Choat et al., 1993), in swimming ability (Stobutzki and Bellwood, 1994; Leis et al., 1996; Stobutzki and Bellwood, 1997; Wolanski et al., 1997), and in the ability of larvae to interact with current velocity. For example, at relatively high current velocities, settlement-stage larvae that are photopositive but that have limited swimming speeds may not have the ability to respond to a light cue and swim into a light trap as they are carried past the sampling device. Conversely, larvae with strong swimming abilities may be able to avoid capture by channel nets at lower current velocities. Thus the relationship between the sensitivity to light cues and the ability to respond to such cues by larvae (determined by developmental stage, swimming ability, and current velocity) should determine the relative catch efficiency of these sampling devices.

Here we compare and contrast the relative number, taxonomic composition, and size of settlement-stage fish larvae caught in light traps and in channel nets deployed at two reefs that differ substantially in current velocity. Because these devices collect larvae either actively or passively, we examined 1) whether light traps are more selective and catch fewer taxa (families) than channel nets, 2) whether light traps catch larger settlement-stage larvae than chan-

nel nets, and 3) with higher current velocity, whether the relative effectiveness of light traps to channel nets decreases, resulting in fewer taxa and a lower abundance of settlement-stage larvae in light traps (with lower current velocity the opposite is true). The relative abundance and taxonomic composition of larvae caught by these two sampling devices, and how they may be modified by current velocity, might result in different interpretations concerning both magnitude and variation in larval supply.

Methods

Study sites

We conducted this study using light traps and channel nets deployed each day, from 30 July through 11 August 1997 at Lee Stocking Island (LSI), Bahamas, bracketing the new moon phase in the lunar cycle when settlement-stage fish larvae are more abundant (Thorrold et al., 1994b). Two fore-reef sites were selected *a priori* for study based upon our impression of marked differences in current velocity: South Bock Cay (So. Bock) northwest of LSI and southeast LSI (S.E. LSI), approximately 7 km south of So. Bock. So. Bock is near a channel between two cays and experiences moderate to strong tidally driven currents, whereas S.E. LSI is far from a channel where there is relatively low current velocity (Fig. 1).

Light traps

We deployed three light traps at each site on each day, from 30 July to 11 August 1997. Each of the three traps at a site was a different modification from two basic designs, with each trap rotated among stations within a site to account for any trap- or location-specific biases. One trap design had a 65-cm diameter polycarbonate top and 1.5-mm nylon mesh enclosing a volume of 200 L, with four clear plastic funnels as fish entrance holes and a fluorescent light powered by nickel-cadmium rechargeable batteries (see Sponaugle and Cowen, 1996b). A second trap design was similar but had an 80-cm diameter wood top instead of a polycarbonate top, a larger volume of 360 L, twice the number of entrance holes, a fluorescent light powered by rechargeable sealed lead-acid batteries, and an automatic timer for turning on the light remotely. The third trap design was composed of a rectangular plexiglas trap (42 cm × 38 cm × 70 cm) with rigid plexiglas panels, a plastic tray, and four entrance slots, constructed to enclose a volume of 110 L based on the design of Munday et al. (1998), but having the same electronics design as that for traps made with polycarbonate tops. All light traps were placed 3–4 m below the sea surface, suspended from moorings with subsurface buoys, and stationed approximately 12–15 m in front of each reef and 50–60 m from each other in a linear array along the offshore edge of the reef. Traps were deployed between 1730 and 1830 h and retrieved the following morning between 0900–1030. All fishes (except for ubiquitous clupeids and atherinids) were collected and placed in vials of 70% or 95% ethanol, identified to family, and later measured with vernier calipers to the nearest 0.1 mm standard length (SL).

Channel nets

We deployed one surface (0–1 m depth) and one subsurface (2–4 m depth) channel net at each site on each day (30 July to 11 August 1997) at a distance of approximately 50 m offshore of the center of the light-trap array. The channel nets were based on the design of Shenker et al. (1993), had a mesh size of 2 mm, and were positioned 30 m apart. The nets were suspended from surface buoys moored to concrete blocks or mooring anchors, allowing them to turn and fish both ebb and flood mixed-semidiurnal tides. The subsurface net mouth opening was 2 m wide × 2 m high. The mouth of each surface net was 2 m wide × 1 m high and was equipped with a General Oceanic Model 2030R2 flow meter and low-speed rotor blade suspended in the mouth opening. Flow-meter readings were recorded from the surface channel net to estimate relative current velocity between the two sites. All nets were equipped with PVC (polyvinylchloride) rods along the length of the netting to prevent entanglement during slack tides, and the codends were constructed to sink and close the end of the net to contain fish larvae during times of very low current velocity. Nets were deployed and retrieved at approximately the same time of day as the light traps. Channel nets were not sampled at dusk to distinguish catches during the day from the following night because previous studies indicated that daytime catches account for a very minor percentage of the

total number of fish transported onto the Great Bahama Bank (Shenker et al., 1993; Thorrold et al., 1994c). At the laboratory, samples were rough-sorted to remove debris, fixed with 10% formaldehyde for 24–72 h, and then transferred to 70% isopropyl alcohol for later identification. Fish were measured with vernier calipers to 0.1 mm SL.

Analysis

To compare the number of taxa collected by light traps and channel nets between sites and for both sites combined, we summed the total number of families caught by each sampling device to calculate family richness. We also used the Brillouin index of species diversity (Magurran, 1988) to compare the diversity of families of fish larvae between sampling methods and sites. This index is preferable to the Shannon-Weiner index because samples collected by light traps and channel nets are nonrandom; for example, light traps produce biased samples based on the sensitivity of species to a light cue.

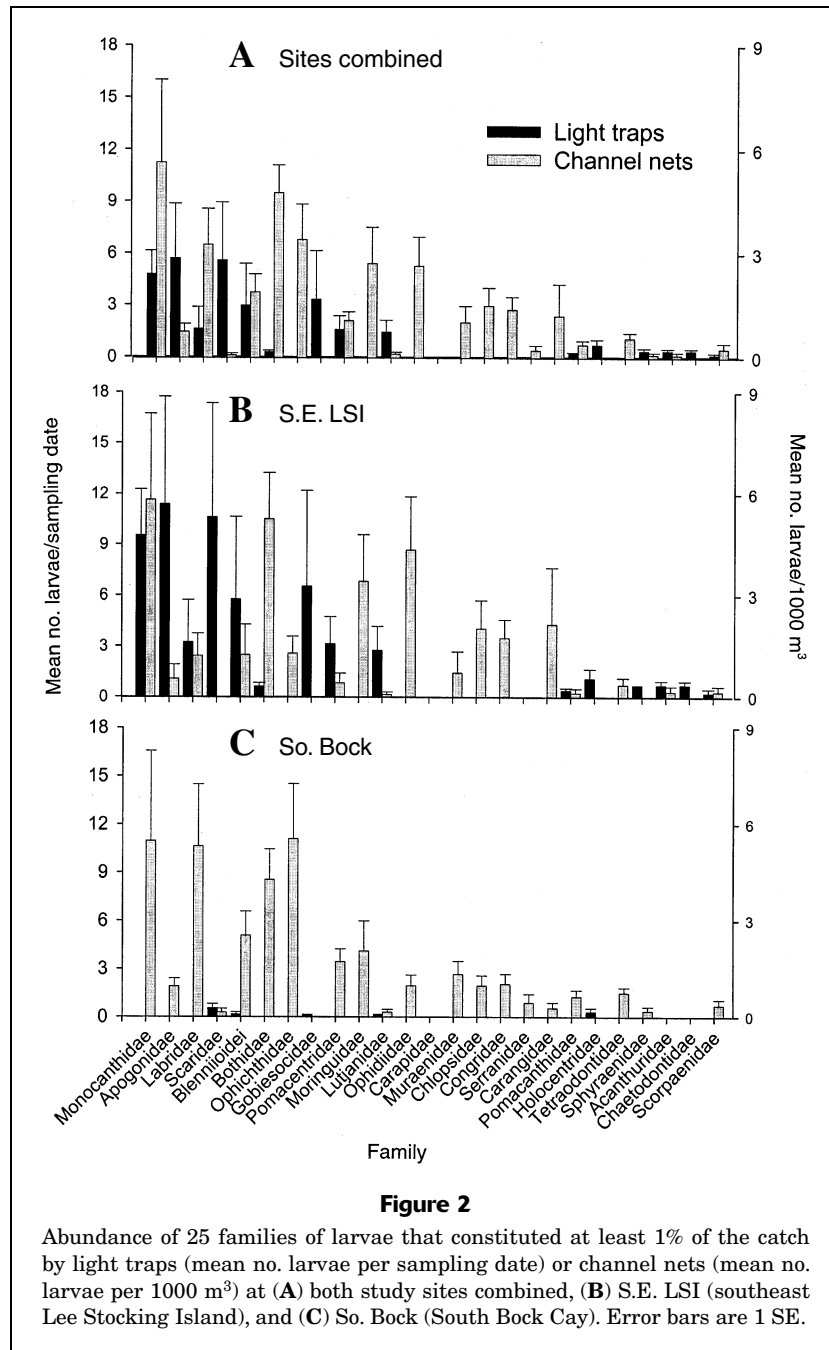
To compare the relative abundance of families caught by light traps and channel nets between sites and for both sites combined, we standardized catches in channel nets to the number of larvae per 1000 m³, using flow meter readings recorded each day, and we standardized catches from light traps as the number of larvae per day. We could not standardize catches to catch per unit of effort because the length of time that the lights were operational was variable and dependent on the type of light device (see heading “Light traps”) and variance in battery life. Moreover, the volume over which light traps attract larvae is difficult to quantify, especially when external factors such as current velocity may largely affect catch rates (Thorrold, 1992; Meekan et al., 2000), and Meekan et al. (2000) suggested that it is useless to convert catch rates into densities.

We used Spearman's rank correlation coefficient (Zar, 1984) to compare the relative abundance of taxa that represented at least 1% of the catch (Choat et al., 1993) for either sampling device. We also used this correlation coefficient to compare the relative abundance of taxa caught by surface and subsurface channel nets between sites for taxa that represented at least 1% of the catch for either net. In order to determine whether there were significant differences in the mean, median, and maximum length of families of fish larvae between light traps and channel nets, we used a Wilcoxon paired-sample test (Zar, 1984) in which differences in length for each family caught by both sampling devices were ranked. Finally, we used a *t*-test to test for significant differences in current velocity and the proportional abundance of total larvae caught by each sampling device between sites.

Results

Richness, diversity, relative abundance, and individual size

According to our hypotheses in regard to active and passive collection of larvae, both family richness and diversity would differ between light traps and channel nets. A total



of 2111 larvae were collected from light traps ($n=849$; 78 samples) and channel nets ($n=1262$; 26 surface and 26 sub-surface samples), representing 20 and 33 families, respectively (Table 1), combining blenniids and labrisomids as blennioids, and not including clupeid and atherinid fishes. Synodontids were excluded from further analysis because of the presence of large postsettlement individuals in light traps. For families that constituted at least 1% of the total catch by at least one of these sampling methods, carapids, chaetodontids, gobiesocids, and holocentrids were not caught in channel nets. Conversely, carangids, chlopsids, congrid, muraenids, ophichthids, ophidiids, and

tetraodontids were not represented in light-trap samples. Channel nets had higher family richness and diversity at S.E. LSI, So. Bock, and at both sites combined (Table 2) than did light traps.

There was no concordance in the rank order of abundance of families collected by light traps and channel nets at either S.E. LSI ($r_s=-0.358$, $n=25$, $P>0.05$), So. Bock (Spearman's rank correlation coefficient: $r_s=-0.120$, $n=25$, $P>0.05$), or at both sites combined ($r_s=-0.162$, $n=25$, $P>0.05$), including all families that represented at least 1% of the catch of either sampling device (Fig. 2). Similarly, there was no correlation in rank abundance of

Table 1

Total number of fish larvae collected from light traps and channel nets at South Bock Cay and at southeast Lee Stocking Island from 30 July to 11 August 1997. The families Blenniidae and Labrisomidae are combined as Blennioidei. Collections from surface and subsurface channel nets each day have been standardized as no./1000 m³. Percentage of total catch of larvae at each site for each family is denoted by (%) for light traps and for channel nets (surface and subsurface nets combined). Asterisks (*) denote families that represented at least 1% of the total catch by light traps or channel nets.

Family	South Bock Cay					Southeast Lee Stocking Island				
	Light traps		Channel nets			Light traps		Channel nets		
			Surface	Subsurface	(%)			Surface	Subsurface	(%)
Acanthuridae*						10	(1.2)	0	4.0	(0.5)
Albulidae			9.1	0	(0.9)			0	8.1	(0.9)
Antennariidae			0	1.6	(0.2)			2.4	0	(0.3)
Apogonidae*			14.1	10.7	(2.4)	148	(17.9)	10.6	3.6	(1.6)
Belonidae			1.4	0	(0.1)					
Blennioidei*	2	(9.5)	24.1	41.8	(6.5)	75	(9.1)	27.4	5.0	(3.7)
Bothidae*			89.3	21.7	(11.0)	8	(1.0)	136.9	0	(15.6)
Callionymidae			0.8	0	(0.1)					
Carangidae*			4.1	3.0	(0.7)			56.0	0	(6.4)
Carapidae*						30	(3.6)			
Chaetodontidae*						9	(1.1)			
Chlopsidae*			24.4	0.9	(2.5)			52.8	0	(6.0)
Congridae*			25.9	0.8	(2.6)			45.4	0	(5.2)
Diodontidae								3.2	0	(0.4)
Exocoetidae			0	0.8	(0.1)					
Gobiesocidae*	1	(4.8)				85	(10.3)			
Gobiidae	2	(9.5)	0	2.4	(0.2)					
Holocentridae*	4	(19.0)				14	(1.7)			
Labridae*			17.8	120.6	(13.7)	42	(4.9)	11.6	20.1	(3.6)
Lutjanidae*	1	(4.8)	1.4	2.3	(0.4)	36	(4.4)	0	2.1	(0.2)
Microdesmidae						1	(0.1)			
Monacanthidae*			118.4	24.0	(14.1)	124	(15.0)	146.1	5.4	(17.3)
Moringuidae*			50.7	2.6	(5.3)			88.8	0	(10.2)
Muraenidae*			33.0	1.6	(3.4)			18.6	0	(2.1)
Ogcocephalidae			4.4	3.4	(0.8)			12.9	0	(1.5)
Ophichthidae*			127.3	16.9	(14.3)			32.4	1.3	(3.8)
Ophidiidae*			18.2	7.1	(2.5)			96.2	16.8	(12.9)
Pomacanthidae*			14.6	1.7	(1.6)	5	(0.6)	3.2	0	(0.4)
Pomacentridae*			35.9	8.9	(4.4)	41	(5.0)	11.0	0	(1.3)
Priacanthidae			1.4	0	(0.1)					
Scaridae*	8	(38.1)	0	3.7	(0.4)	138	(16.7)			
Scorpaenidae*			4.6	4.8	(0.9)	3	(0.4)	4.0	0	(0.5)
Serranidae*			0	11.5	(1.1)					
Sphyraenidae*			4.0	0.8	(0.5)	9	(1.1)			
Syngnathidae			4.5	0	(0.4)	1	(0.1)	18.6	0	(2.1)
Synodontidae	2	(9.5)	1.4	0	(0.1)	48	(5.8)	4.8	0	(0.5)
Tetraodontidae*			17.9	1.7	(1.9)			9.7	0	(1.1)
Unidentified	1	(4.8)	7.3	28.9	(3.6)			12.3	0	(1.4)
Total larvae	21		656.0	324.2		828		804.9	66.4	

Table 2

Richness and diversity of families of fishes caught by light traps and channel nets.

	Sites combined	South Bock Cay	Southeast Lee Stocking Island
Richness (no. families)			
Light traps	19	6	18
Channel nets	32	30	23
Diversity (Brillouin index)			
Light traps	2.845	1.179	2.832
Channel nets	3.183	3.199	3.027

subsurface and surface channel nets, including only those families that represented 1% of the catch of either net for S.E. LSI ($r_s=0.227$, $n=16$, $P>0.05$; Fig. 3A) or for So. Bock ($r_s=0.088$, $n=16$, $P>0.05$; Fig. 3B). In addition, the sizes of larvae (Table 3) caught by light traps and channel nets (but excluding families with <3 individuals collected per sampling device [acanthurids, gobiids, and syngnathids]) did not differ in the mean (sign test: $n=11$, $P>0.05$), median ($n=11$, $P>0.05$), or maximum ($n=11$, $P>0.05$) length between sampling devices. For five families that differed in length between sites and that were represented by at least three individuals (Table 3), channel nets caught significantly larger larvae at S.E. LSI than at So. Bock in mean ($n=5$, $P=0.03$) and median ($n=5$, $P=0.03$) length, but not in maximum length ($n=5$, $P>0.05$).

Current velocity and catch efficiency

Over a 10-d period in which flow-meter readings were taken simultaneously at both sites, mean daily current velocity was three-times higher at So. Bock than at S.E. LSI (t -test: $t=-7.92$, $df=18$, $P=0.0001$; Fig. 4A). Light traps deployed at So. Bock caught on average only 3.1% of the total number of fish collected by light traps at both sites, whereas the channel nets positioned at S.E. LSI caught an average of 43.8% of the total catch for nets positioned at both sites (Fig. 4B). The mean proportional abundance of all larvae caught by light traps was significantly lower at So. Bock than at S.E. LSI ($t=-50.3$, $df=24$, $P<0.0001$) but there was no significant difference in proportional catch for channel nets ($t=1.36$, $df=24$, $P=0.19$). The difference in catch efficiency for each sampling device was also indicated by the opposite trends of abundance of taxa (apogonids, blennioids, labrids, pomacentrids, but not monocanthids) caught in at least nominally greater numbers by light traps at the low-current site (S.E. LSI) compared with the greater catch of these same taxa by channel nets at the high-current site (So. Bock). In addition, and consistent with our hypotheses concerning current velocity, light traps had higher family richness and diversity at S.E. LSI than at So. Bock, whereas the opposite was true for channel nets (Table 2).

Discussion

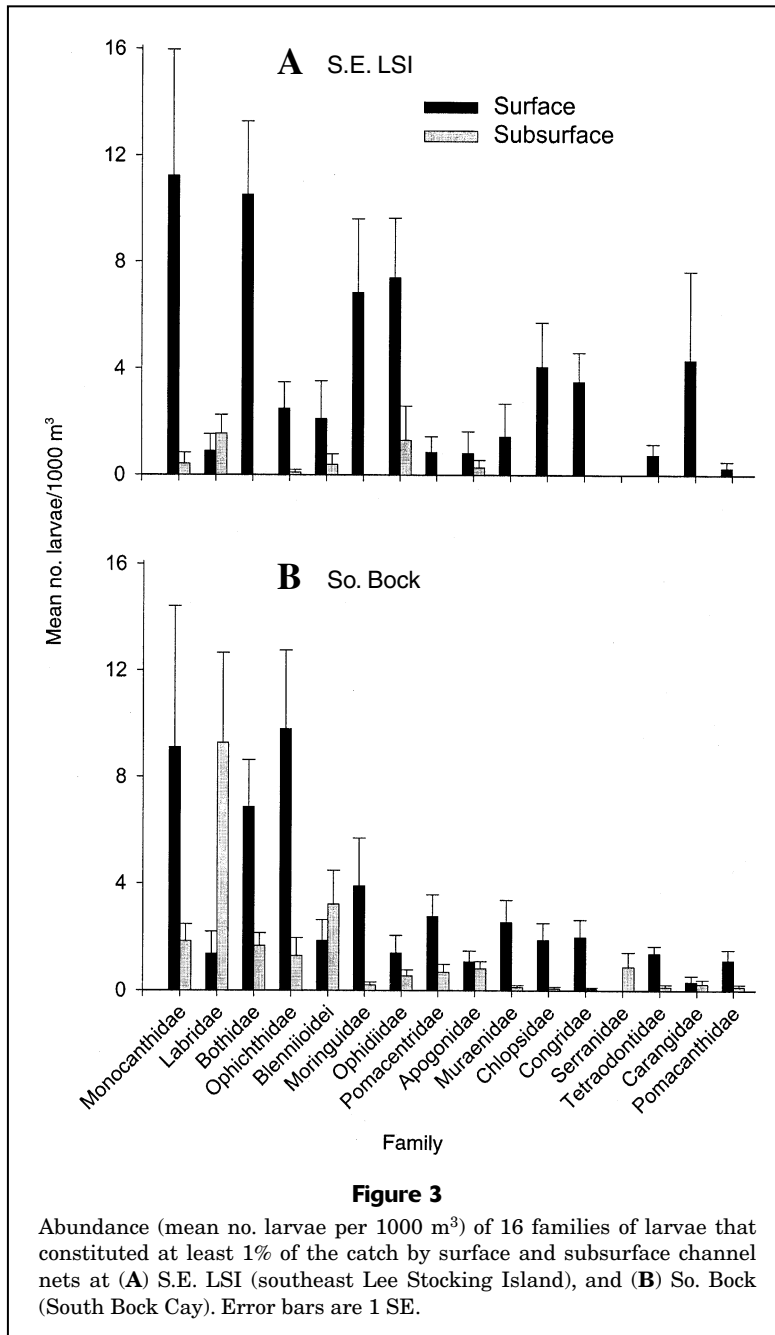
Differential representation of taxa between sampling methods

Light traps and channel nets differed in the taxonomic composition and the relative abundance of their catch. Expectedly, channel nets had appreciably higher family richness and diversity than did light traps, and this is consistent with our hypothesis that light traps are more selective (also see Choat et al., 1993) because not all larvae exhibit a photopositive response. One of the main differences in the relative abundance of larvae between sampling devices in the central Bahamas is that channel nets collect a large proportion of labrids and leptocephalus larvae (Shenker et al., 1993; Thorrold et al., 1994a, 1994b, 1994c; Mojica et al., 1995; this study) but light traps do not (this study). Depth-dependent distributions of larvae are also likely to contribute to differences in the relative abundance of taxa because light traps catch larvae from an unknown depth range (over which larvae are attracted to the light) whereas surface and subsurface channel nets operate at discrete depths of 0–1 m and 2–4 m, respectively. Moreover, not only can surface and subsurface channel nets differ in their catch (Fig. 3), the relative abundance of particular taxa between surface and subsurface nets can switch over time (Thorrold et al., 1994c).

The similar sizes of larvae from families caught by both light traps and channel nets are somewhat inconsistent with the findings by Choat et al. (1993), who found that larvae caught by light traps were larger than those caught by towed nets and seines. They attributed this difference in size to a stronger photopositive response by larger pelagic larvae. The smaller size of larvae that they caught in towed nets and seines may also indicate that larger larvae may better sense the presence of these nets and avoid capture. Channel nets may decrease net avoidance by larvae because their stationary position may lessen water disturbance and hence detection of the net by incoming larvae, or possibly because other larval behaviors are exhibited.

Differential representation of taxa between sites

The greatest difference between light traps and channel nets was in their relative catch between sites. Light traps were ineffective in collecting larvae at So. Bock, whereas channel nets collected a lower but not significantly different proportion of larvae at S.E. LSI. This result cannot be explained simply by differences in the abundance of taxa between sites; the same pattern was observed for taxa sufficiently represented by both sampling devices (apogonids, blennioids, labrids, pomacentrids). These sites did differ substantially in mean current velocity, with average flow rates at So. Bock three times higher than at S.E. LSI. Shenker et al. (1993) observed that larvae collected by channel nets were significantly more abundant at a sampling station that also had greater current velocity, and this finding is consistent with our results. Similarly, Thorrold (1992) observed that light traps that were allowed to drift with water masses collected signifi-



cantly more fish larvae than light traps anchored to the sea floor, apparently independent of taxa. Thorrold noted that this pattern was unexpected because more water (and presumably more larvae) should pass by anchored traps, and he suggested that the ability of larvae to swim to and enter anchored traps may be difficult under high-current conditions.

Although we conclude that between-site differences in relative catch by light traps and channel nets in our study were related to current velocity, the relationship between catch and average current velocity was not linear. The proportional abundance of larvae caught in light traps was

over 31 times higher at S.E. LSI than at So. Bock, whereas the larval catch in channel nets was only 1.3 times higher at So. Bock than at S.E. LSI. The nonlinear relationship between current velocity and larval abundance may represent a threshold response in which the efficiency of light traps and channel nets may change with different current velocities. The mechanisms causing such relationships might be that fish larvae are able to orient to and swim into light traps more easily under lower current velocities, whereas fish larvae might more easily detect and avoid channel nets because of greater hydrodynamic disturbances in front of nets during higher current velocities.

Table 3

Mean (± 1 SE), median, and range in size of larvae (mm standard length) collected in light traps and channel nets at South Bock Cay and at southeast Lee Stocking Island from 30 July to 11 August 1997. The families Blenniidae and Labrisomidae are combined as Blennioidei.

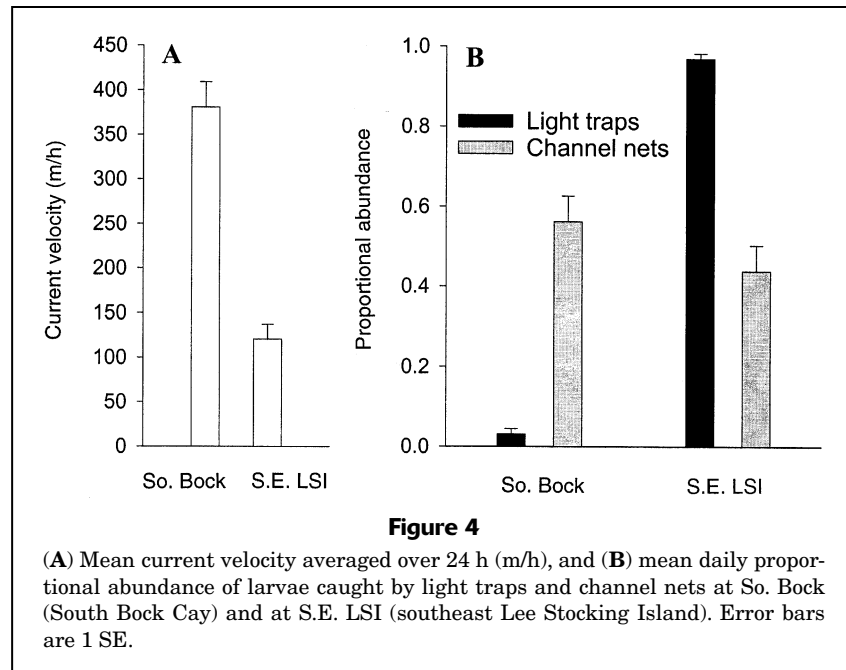
Family	South Bock Cay				Southeast Lee Stocking Island			
	Mean (SE)	Median	Range	<i>n</i>	Mean (SE)	Median	Range	<i>n</i>
Light traps								
Acanthuridae					25.3 (0.31)	25.2	(24.2–26.9)	9
Apogonidae					9.1 (0.12)	8.6	(6.6–14.2)	150
Blennioidei	12.6 (0.20)	12.6	(12.4–12.8)	2	11.8 (0.18)	11.6	(7.8–18.7)	83
Bothidae					13.7 (0.45)	13.5	(12.0–15.0)	7
Gobiidae	8.8 (0.10)	8.8	(8.7–8.9)	2				
Labridae					9.3 (0.29)	8.6	(6.9–12.3)	32
Lutjanidae	11.7	11.7	(11.7–11.7)	1	15.0 (0.39)	14.3	(12.6–20.8)	29
Monacanthidae					11.9 (0.19)	11.4	(7.4–21.4)	128
Pomacanthidae	13.9	13.9	(13.9–13.9)	1	9.0 (0.24)	9.1	(8.3–9.4)	4
Pomacentridae					10.9 (0.21)	10.8	(8.7–13.7)	40
Scaridae	9.1 (0.24)	8.9	(8.7–10.3)	6	8.6 (0.08)	8.7	(5.9–10.8)	120
Scorpaenidae					6.8 (0.20)	6.8	(6.4–7.1)	3
Sphyraenidae					18.0 (0.90)	18.4	(13.0–21.5)	9
Syngnathidae					40.5	40.5	(40.5–40.5)	
Channel nets								
Acanthuridae					24.7	24.7	(24.7–24.7)	1
Apogonidae	10.2 (0.24)	9.8	(8.9–14.2)	26	9.8 (0.43)	9.8	(9.0–10.5)	3
Blennioidei	12.7 (0.12)	12.7	(10.8–17.8)	65	13.6 (0.76)	12.8	(11.6–18.1)	8
Bothidae	14.8 (0.14)	14.8	(7.0–17.8)	103	16.0 (0.77)	15.1	(12.0–36.2)	29
Gobiidae	13.5 (0.24)	13.6	(13.0–13.8)	3				
Labridae	11.4 (0.06)	11.4	(9.5–13.6)	154	13.7 (1.3)	12.4	(10.9–28.7)	13
Lutjanidae	13.6 (0.38)	13.7	(12.0–14.7)	6	11.8	11.8	(11.8–11.8)	1
Monacanthidae	12.2 (0.24)	12.0	(5.2–51.3)	204	12.8 (0.29)	13.0	(7.7–18.6)	45
Pomacanthidae	8.9 (0.14)	9.0	(7.5–9.4)	12	9.2	9.2	(9.2–9.2)	1
Pomacentridae	10.2 (0.20)	9.8	(8.8–13.9)	32	12.6 (0.95)	11.8	(11.5–14.5)	3
Scaridae	9.0 (0.13)	9.0	(8.6–9.2)	4				
Scorpaenidae	8.0 (0.35)	8.1	(6.7–9.6)	9	8.1	8.1	(8.1–8.1)	1
Sphyraenidae	23.9	23.9	(23.9–23.9)	1	18.6 (3.9)	19.9	(11.3–24.6)	3
Syngnathidae	32.9 (16.9)	25.7	(7.8–65.1)	3	35.0 (1.8)	35.0	(33.2–36.8)	2

Indeed, there may be important consequences in sampling reef fish larvae among multiple sites that vary in current velocity. Current-dependent catch efficiency could confound estimates of spatial variation in larval abundance if those sites vary substantially in current velocity. For example, deploying light traps to sample larval abundance at several locations may result in higher abundances at sites with low current. This result could indicate actual larval distributions, such as accumulation of larvae on the leeward side of an island, or it could simply reflect current-dependent catch efficiency. In the latter case, estimates of larval distribution and subsequent interpretations of such distributions (e.g. larval retention) would be flawed.

As with all sampling devices, light traps and channel nets have both advantages and disadvantages for estimating larval abundance. Light traps may collect a larger proportion of settlement-stage larvae for those fishes that exhibit a photopositive response, but they catch fewer taxa and

sample an unknown volume of water (Choat et al., 1993) in relation to channel nets. Our results indicate an important factor in selecting an appropriate device for estimating larval supply—namely, the hydrodynamic conditions under which the device will be deployed. Use of one sampling device, either light traps or channel nets, would have resulted in biased and potentially inaccurate relative estimates of larval abundance between So. Bock and S.E. LSI. In more recent studies, several methods have been used to estimate the abundance of as many larval fishes as possible (e.g. Leis et al., 1998), and in a comparison of light traps and towed nets in sampling freshwater fishes, Gregory and Powles (1988) concluded that both sampling devices should be used to avoid bias in the collection of larvae.

The use of both light traps and channel nets simultaneously can provide less biased estimates of spatial variation in taxonomic composition and larval supply of coral-reef fishes among sites that vary in current velocity. This com-



bination is problematic, however, because there is no “common currency” between light traps and channel nets. The volume of water sampled by light traps is unknown, and capture rates of larvae are very low (Meekan et al., 2000), so that the catches of light traps and channel nets cannot be easily standardized. The value of these and other larval sampling devices is that they provide a measure of temporal and spatial variation in relation to larval supply. However, the nonlinear relationship between current velocity and larval abundances observed in our study could compromise such estimates and further complicate standardization among sampling devices. Additional research is necessary to account for method-dependent differences in larval abundance among sites that differ in hydrodynamic or other environmental conditions.

Acknowledgments

We thank A. King, C. McKinney-Richards, K. Overholtzer, and S. Whitcraft for field assistance, E. Maddox and B. Victor for verifying larval identifications from our collections, G. Albany and A. Summers for assistance with light-trap electronics, and the staff of the Caribbean Marine Research Center at Lee Stocking Island for logistical support. This research was supported by NSF grants OCE-96-17483 and OCE-99-96053 (M. Hixon), NSF OCE-99-96053 (M. Carr), and by NOAA National Undersea Research Program grant 97-3109 (M. Hixon).

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