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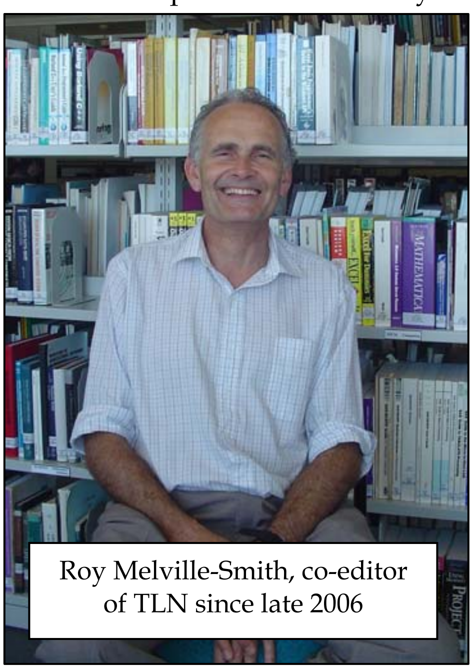
The Lobster NEWSLETTER

ANNOUCEMENTS

The Lobster Newsletter Belatedly Welcomes New Editor and Expresses Gratitude to Departing Editor

Until recently, there were three editors for *The Lobster Newsletter(TLN)*: Peter Lawton, Roy Melville-Smith and Mark Butler. Roy was the most recent co-editor to join *TLN*, replacing John Booth at the end of 2006. Roy took the lead in producing the last edition of *TLN*, so he sneaked into the editorship unannounced. It is therefore our pleasure to formally welcome him on board.



Roy Melville-Smith, co-editor of TLN since late 2006

Roy is South African born, but now lives in Australia. He has spent much of his working life on providing research for management on West and South Coast rock lobsters in South Africa, and now does the same for the Western and Southern rock lobster species in Western Australia, where he lives. He has published widely in the lobster literature and many of you are no doubt familiar with his work.

We are also saying goodbye to Peter Lawton who has recently decided to step down as a co-editor. We have very much enjoyed working with Peter in this capacity over the years, and thank him in particular for running our mailing list so efficiently.

Roy and Mark have decided to continue with just two editors of *TLN*, much like it was when Stan Cobb and John Pringle first began *TLN* over 20 years ago.

Please keep your articles rolling in – those of you in the southern hemisphere send your articles to Roy (rmsmith@fish.wa.gov.au), and those in the northern hemisphere to Mark (mbutler@odu.edu). The next edition of *TLN* will come out early in the second half of 2008.

Peter Lawton, departing editor of TLN

RESEARCH NEWS

Meet *Palinurus barbarae* - A New Spiny Lobster Species from a Submerged Seamount!

From: Johan Groeneveld, Charlie Griffiths and Conrad Matthee

A new spiny lobster species has been described from catches made by a fishing vessel in the south-western Indian Ocean! This find increases the number of known *Palinurus* species to six, of which three occur in the south-western Indian Ocean (*Palinurus gilchristi*, *P. delagoae*, and now also *P. barbarae*), two in the north-eastern Atlantic and Mediterranean (*P. elephas* and *P. mauritanicus*), and one at the Cape Verde Islands (*P. charlestoni*). The new species is *Palinurus barbarae* Groeneveld *et al*., 2006, named after Barbara Groeneveld (1973-2004), and differs from the other 5 species based on morphology and a distinct mtDNA composition. The only known population is on Walters Shoals, the shallowest submerged seamount along the Madagascar Ridge, approximately 720 km south of the southern tip of Madagascar, and 1100 km due east from Durban, South Africa.

We described *P. barbarae* (Fig. 1) from 19 whole frozen specimens of both sexes (129 mm < CL < 186 mm) in a good condition, and genetic samples from 50 additional lobsters from Walters Shoals. Fourteen type specimens are lodged in the South African Museum in Cape Town (A45301 – A45303), and the species description appeared in the August 2006 edition of Crustaceana. *Palinurus barbarae* is a large (up to 3.5 kg observed) brick-red spiny lobster with the typical morphology of the *Palinurus* genus. It can be distinguished from its nearest neighbor, *P. delagoae* from eastern South Africa and Mozambique, based on spine counts on antennal peduncles (17-34 on each peduncle in *P. barbarae* and 8-16 in *P. delagoae*), a groove with angular lip on the posterior carapace rim of *P. barbarae* (absent or rudimentary in *P. delagoae*), sharper and more anteriorly directed frontal horns, sharper spur-like pleura, and a more uniform brick-red coloration with small pitted white specks. The sternal plate of *P. barbarae* is heavily striated with broad red bands on white background, whereas that of *P. delagoae* is white or with rudimentary striations.

Figure 1. Johan Groeneveld with two specimens of *P. barbarae*

Combined parsimony and maximum likelihood analyses of the mitochondrial DNA 16S and COI regions (1001 base pairs) of all known *Palinurus* taxa (incl. *P. barbarae*) support the existence of at least six monophyletic species (unpublished data, University of Stellenbosch). The samples of *P. barbarae* at Walters Shoals consistently cluster as a distinct taxon, and a more detailed population genetic investigation based on the hypervariable mtDNA control region (334 animals, 547 base pairs) support this finding. The latter analysis suggests that *P. barbarae* has no female gene flow with *P. delagoae* (eastern South Africa), and that these two taxa are separated by at least 27 mutational steps, translating to a mtDNA divergence of 5% (Gopal *et al.*, 2006).

Our finding now questions the present taxonomic classification of the *Palinurus* lobsters inhabiting the shelf-edge of southern Madagascar. The Madagascan population is separated from *P. barbarae* at Walters Shoals by 720 km and deep intervening waters, and from *P. delagoae* by the Mozambique Channel and Agulhas Current. The Madagascan lobsters were tentatively grouped with *P. delagoae* from South Africa and Mozambique by Berry & Plante (1973), in their revision of the genus in the south-western Indian Ocean, but we think that the Madagascan lobsters may be closer related to *P. barbarae* than to *P. delagoae.* We hope to get hold of samples from southern Madagascar for a genetic comparison, and will update newsletter readers soon.

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Probing Uncharted Waters: a Passive Postlarval Collector for the American Lobster

From Richard Wahle, Carl Wilson, Matt Parkhurst, and Charlene Bergeron

One of the frustrating things about studying the larval ecology of the American lobster is that passive collectors, like the ones long used in spiny lobster research, just don't work. Now, in a collaboration supported by NOAA's Northeast Consortium fishermen and scientists have put their heads together to combine what they know about lobster nursery habitats and gear design to come up with a collector design that is opening a window on postlarval settlement in places inaccessible to diver surveys.

Over the past two decades diver-based suction sampling of near-shore lobster nurseries has been giving a geographically expanding view of time trends of postlarval settlement in New England and Atlantic Canada (Fig. 1; e.g., Wahle and Incze 1997, Incze et al. 1997, Steneck and Wilson 2001, Wahle et al. 2004). But while the survey is central to our emerging understanding of recruitment variability in the fishery, huge expanses of the seabed remain inaccessible to divers. Here we briefly summarize the results of proof-of-concept field trials with a fisherman-friendly collector design that has led to an emerging US-Canadian harvester-scientist partnership to deploy collectors on an unprecedented scale.

Proof-of-Concept Trials: The key to success with passive postlarval collectors for lobsters seems to be in mimicking the natural nursery habitat. This may explain why early attempts to use fibrous materials like air conditioner filters or plastic laminates collectors used for spiny lobster postlarvae (Phillips 1972, Booth et al. 1986, Butler and Herrnkind 1997) have failed to attract postlarval clawed lobsters. For *Homarus,* collectors that provide crevices and hiding places like its cobble-boulder nurseries prove more

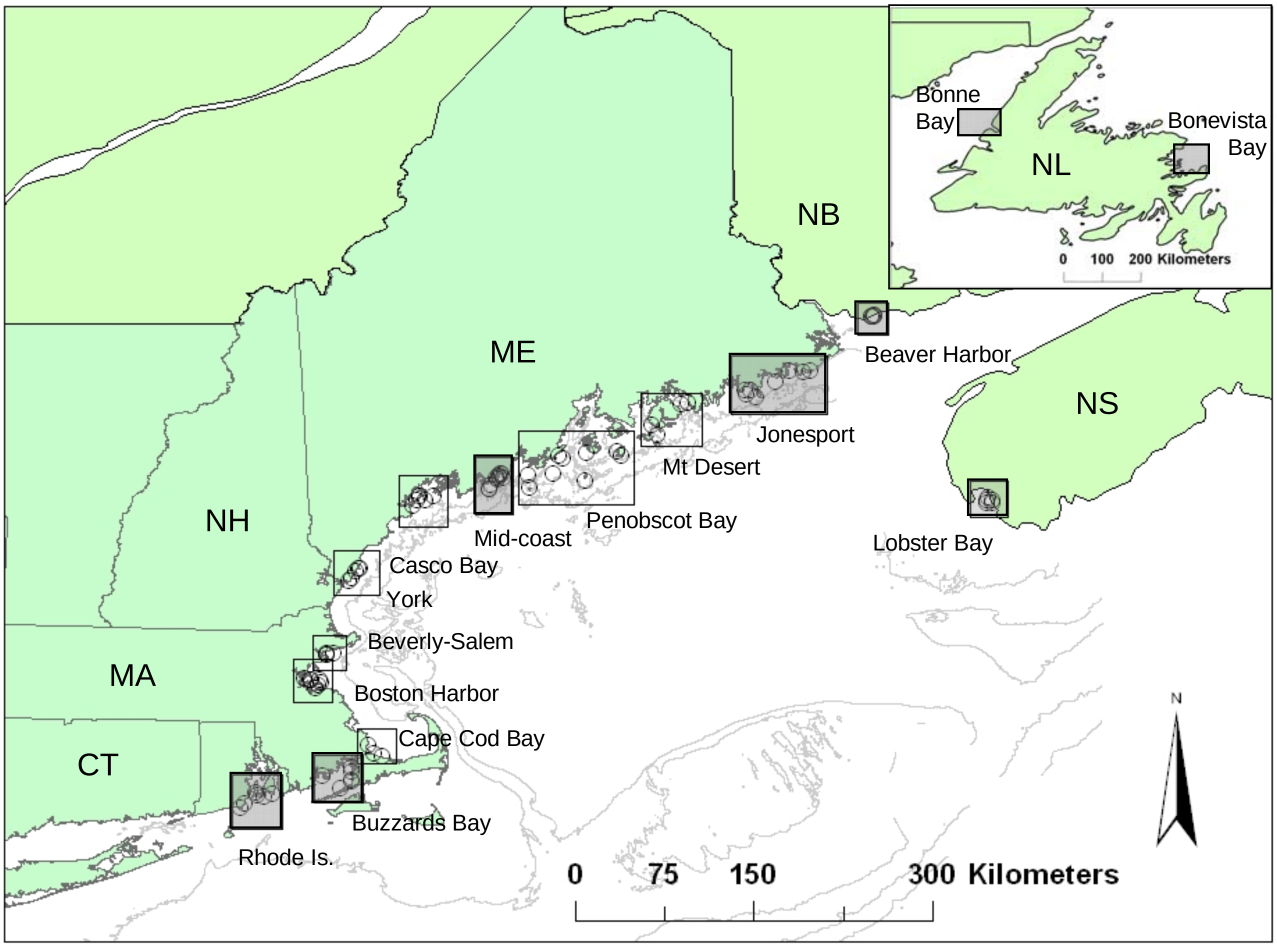

Figure. 1. New England lobster settlement index sampling sites. All sites currently sampled by divers are <10 m depth. Boxes surround sites used for regional averages; shaded areas denote regions where postlarval collectors were deployed in 2007 (Norwegian site not shown). For annual updates on the settlement index go to www.bigelow.org/srs/lobsterset.html

effective. One design, made of stacked layers of interlocking PVC pipe, worked quite well (Palma et al. 1998, 1999, Wilson 1999), but it was expensive to build and too light to take the punishment of the open coast environment. Another design, made with the raw material of the nursery habitat itself, proved more promising (Wahle and Incze 1997, Incze et al. 1997, Palma et al. 1998). While we didn't relish the prospect of lugging scores of cobble-filled collectors, we could not ignore the common sense advice of our collaborating fishermen to make them heavy so they'd hold ground.

The design is essentially a wire mesh tray filled with cobbles that also lends itself to being set and retrieved with standard commercial trap hauling gear. Its footprint is roughly the size of a lobster trap (Fig 2). We used standard vinyl-coated trap wire mesh used by the lobster industry. The floor and walls were lined inside with a rugged 2-mm plastic mesh to help prevent newly settled lobsters and other organisms from escaping; a heavier plastic mesh overlay prevents chafing of finer mesh. The collectors are filled with clean, rounded cobbles ranging in diameter from 10-15 cm. The top cover, also wire mesh, is fastened to the frame, its 1.5 inch mesh large enough not to deter settling lobsters or crabs, but small enough to keep out larger predators and retain the rocks. The bottom is fitted with oak runners for more rigidity and to aid sliding and stacking on deck. A 4-corner bridle permits the lifting in a horizontal orientation.

Figure 2. Mimicking nature. Collector on the rail of a lobster boat. This collector was fitted with a fine mesh cover that is being removed after the test to evaluate haul-back losses of postlarval lobsters seeded to the collectors.

Our 2005 field trials resulted in two key findings. First, we were able to demonstrate that the new collectors sample newly settled lobsters and crabs in densities comparable to adjacent natural cobble nurseries monitored by divers (Fig. 3). Second, in two different experiments in which divers covered a subset of the collectors before the collectors returned to the surface, we found no significant losses of lobsters from the collectors during retrieval (Fig. 4). It would therefore be unnecessary to incorporate a means to cover the collectors prior to hauling. By the end of the settlement season (mid-October), newly settled lobsters predominated the contents of the collectors, and a considerable number of larger lobsters had also moved in from the surrounding seabed (Fig. 5). Prior work suggests the presence of the larger lobsters does not interfere with postlarval settlement (Wahle and Incze 1997). Associated fauna, also attracted to the collectors, included common *Cancer* crabs, as well as a variety of fishes, including juvenile cunner, sculpins and gunnels, as well as a single snowy grouper, a tropical vagrant, all perhaps boding well for wider application of these collectors. In short, these field trials positioned us well to address our long-standing research question on settlement where divers can't venture.

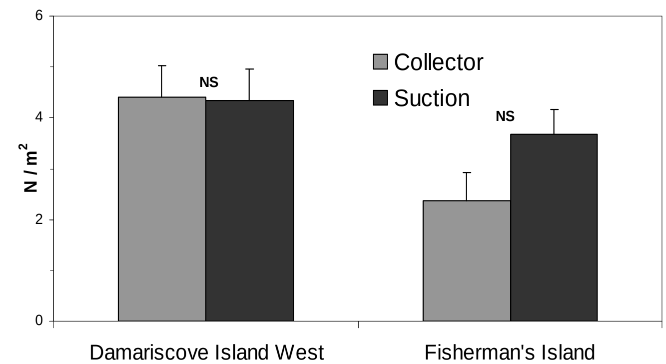

Figure 3. Settlement in collectors versus natural substrate. Average density (+1SE) of newly settled lobster in artificial collectors hauled by fisherman and in adjacent natural cobble nurseries sampled by divers with suction samplers. Densities standardized to numbers per m^2. Results shown for two sites in mid-coast Maine; 10 collectors and 12 suction samples per site. There was no statistical difference in densities estimated by the two methods at either site (Damariscove Is.: $t = 0.15$, $df = 30$, $p = 0.89$; Fishermans Is.: $t = 1.47$, $df = 30$, $p = 0.15$). For an effect size = 1.0 and a pooled SD = 2.0, 20 replicates per group have a statistical resolving power of 0.86, 10 replicates, power = 0.58.

Deepwater Settlement: Based on prior field and laboratory observations of postlarval behavior and anecdotal observations by harvesters, it seemed reasonable to suspect the depth distribution of newly settled lobsters might vary with regional differences in the ocean environment. Previous studies suggested settlement might be limited to areas experiencing temperatures at or above 12°C during the summer (Boudreau et al. 1992, Annis

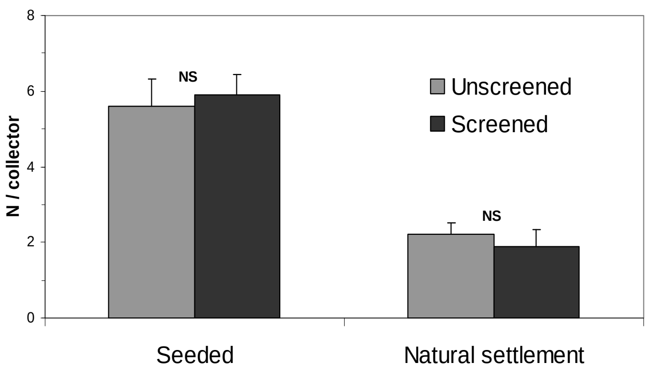

Figure 4. No losses on haul-back. Comparison of the number of lobster settlers recovered in collectors that were covered and not covered with screening prior to haulback in two different experiments. In seeded collectors, 10 hatchery-reared settlers were artificially placed in each of 20 collectors; the next day 10 of the collectors were covered just prior to hauling. To assess losses after natural settlement, 40 collectors were deployed, 20 of which were covered just prior to hauling at the end of the settlement season. There was no statistical difference in the number of lobsters recovered from screened and unscreened collectors in either experiment (Seeded: $t = 0.33$, $df = 18$, $p = 0.74$; Natural: $t = 0.58$, $df = 37$, $p = 0.56$). For an effect size = 1.0 and a pooled SD = 2.0, 20 replicates per group have a statistical resolving power of 0.86, 10 replicates, power = 0.58.

2004, 2005). During the lobster settlement season in southern New England warm water favorable to settlement extends to a much greater depth than it does in the Gulf of Maine. But regional anomalies exist. In the well mixed eastern Gulf of Maine, near the mouth of the Bay of Fundy, late summer temperatures are a notoriously chilly 10-12°C but uniform from surface to bottom, whereas in the thermally stratified southwest parts of the Gulf, off Boston, for example, surface layers can reach 20°C while bottom temperatures at 30 m rarely exceed 7°C. Thus, extensive areas of sea bed, some more suitable than others, may be available for lobster settlement in the Gulf of Maine and southern New England shelf.

With renewed Northeast Consortium support in 2007, we embarked on a 2-year fisherman-scientist collaboration to assess deepwater settlement over a significant portion of the American lobster's geographic range. The specific objectives of the current project are to: (1) determine the depth-wise patterns of lobster settlement in three regions of contrasting oceanography (central and eastern Gulf of Maine and the southern New England shelf); (2) evaluate the link between water column thermal structure and depth patterns of settlement, and (3) better calibrate the diver-based suction sampling and collector-derived data in shallow water. Two more collaborating harvesters (Skip O'Leary of Wakefield, Rhode Island and Norbert Lemieux of Cutler, Maine) joined the team, enabling us to deploy 100 collectors in each of the three regions.

The project has also generated considerable interest among other scientists and harvesters from New York to Norway, some of whom have deployed collectors in their own regions. In 2007 a spectrum of US and Canadian government, academic and industry groups joined the effort, hailing from Memorial University, Newfoundland, University of New Brunswick, University of Massachusetts, and Fisheries and Oceans Canada in partnership with the Fisherman Scientist Research Society. And on the other side of the Atlantic, one group from the Institute of Marine Research, Floedevigen, southern Norway, set out collectors in an attempt to find the elusive settlement stage of *Homarus gammarus.* All told, some 700 collectors were deployed last summer through the combined efforts of these teams. This constitutes the largest synoptic view of lobster settlement to date. Data are still being compiled at this writing, but we can report the deepest (88 m) and northernmost (Bonne Bay, Newfoundland) record of settlement to date for the American lobster. And the emerging patterns are confirming that settlement patterns mirror

water column thermal structure with the greatest densities above the thermocline. All indications are that the 2008 undertaking will broaden the geographic coverage even further, with more collectors deployed from the Gulf of Saint Lawrence to Sweden.

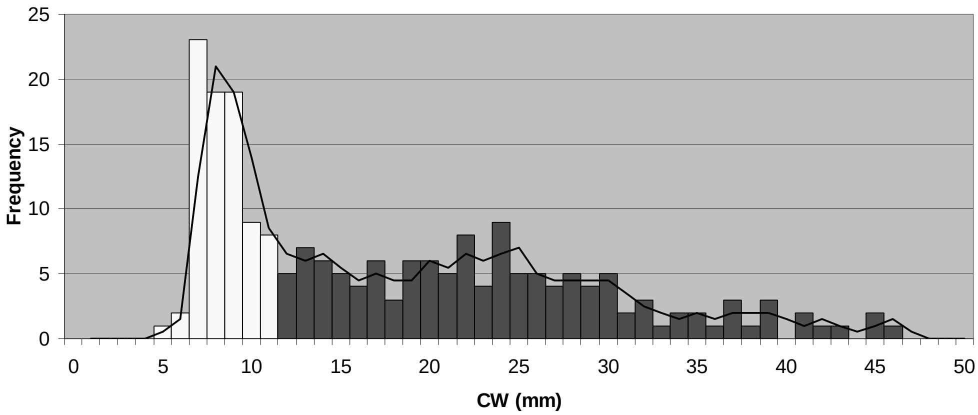

Figure 5. Size frequency distribution of lobsters found in 40 collectors. Lobsters ≤11 mm carapace width are considered settlers (open bars). Larger lobsters immigrated from surrounding habitat. Line is a 2-bin running average.

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Hatchery-reared Stage IV Lobster, *Homarus americanus*, Release: Where and When

From *Michel Comeau*

An American lobster (*Homarus americanus*) enhancement project was initiated by fishermen in 2001 to produce and release stage IV lobster larvae in part of the southwestern Gulf of St. Lawrence (sGSL), Canada. Their goal is to increase the number of early postlarval settlers. However, although larval lobsters have been successful produced through hatcheries for decades in North America (for review see Nicosia and Lavalli, 1999), producing hatchery-reared animals is only half of the undertaking to ensure the success of a stock enhancement/sea ranching project. It is paramount to properly release these hatchery-reared animals in the appropriate habitat.

There are three essential steps to ensure successful benthic settlement of hatchery-reared animals (van der Meeren, 2005). The first and second steps deal with "Handling and Release" and "Roaming and Investigating": alert animals that quickly reach the bottom and immediately search for shelter – those that find shelter quickly have the greatest opportunity to survive. The third step ("In shelter") deals with the availability of acceptable substrate (i.e., where stage IV lobsters can settle in nature and find or dig a shelter to grow and carry on with their life cycle).

Although postlarval lobsters can settle on various substrates (for review see Nicosia and Lavalli, 1999), near-shore habitat with cobble appears to be a preferred habitat for early postlarval lobsters settling (Wahle and Steneck, 1991). To investigate habitat preferences of early postlarval lobsters in the sGSL, information on near-shore physical habitat (substrate and rock size) and lobster density were collected using SCUBA surveys. Divers sampled 10 m² quadrats along 100-m transect lines. Between 2000 and 2005, a total of 15,513 quadrats were sampled at depths between 3-10 m. Lobsters observed were counted, measured, and sex determined. For the analysis, lobsters were pooled in three categories based on their sizes: (1) cryptic, <31 mm of carapace length (CL); (2) juvenile, between 31-69 mm CL; and (3) adult, >69 mm CL. In addition, the type of substrate, the size and aggregation of rocks (reefs) observed in each quadrat were noted. To standardize the information collected by divers, the basic sediment size classification developed by Wentworth (1922) and later modified by Pettijohn (1949) was used: (1) solid sheet of sandstone with possible ledges; (2) boulder, rock >256 mm; (3) cobble, rock between 64-256 mm; (4) gravel, small rock between 4-64 mm; (5) sand, rock grains; and (6) mud, mixture of silt, clay, and fine sand.

The highest density of cryptic animals (2.8 lobster per 100 m²) was observed in habitat characterized by a gravel substrate with boulders and cobbles on top (Table 1). Also, all habitats with the presence of boulders and cobbles could be considered good habitat for cryptic lobsters with densities higher than 1 lobster per 100 m² (Table 1). Based on lobster densities, coastal habitats (less than 10 m) in the sGSL can be classified for lobster preferences. Habitats with a mixture of sand-mud-gravel or solid sheet of sandstone show densities of <1 lobster per 100 m² and can be characterized as poor lobster ground. Marginal lobster habitats are characterized by simple habitats with gravel and/or a mixture of gravel with a solid sheet of sandstone (Table 1). Good lobster habitats are complex and characterized by a soft substrate or solid sheet of sandstone with boulders and cobbles on top. These types of habitat create reefs where lobsters have the opportunity to either find or dig shelters. The highest density (7.6 lobster per 100 m²) was observed in rocky (boulder-cobble-gravel) habitat, which should be considered as prime lobster habitat.

Table 1. Lobster density (per 100 m²) in various coastal (<10 m) habitats.

Habitat	Area (m²)	Density				Lobster
		Cryptic	Juvenile	Adult	Total	Habitat
Sand	1660	0.0	0.0	0.1	0.1	poor
G-S-M	3020	0.2	0.3	0.1	0.6	poor
Hard	22960	0.2	0.7	0.1	1.0	poor
Gravel	27910	0.4	0.7	0.2	1.3	marginal
Gravel-Hard	7740	0.5	1.0	0.2	1.7	marginal
B/C-S-M-G	420	1.4	2.6	0.5	4.5	good
B/C-Hard	26450	1.1	4.6	0.9	6.6	good
B/C	1970	1.6	3.8	1.2	6.6	good
B/C-Gravel	63000	2.8	3.8	1.0	7.6	prime

Hard=solid sheet of sandstone; S=sand; M=mud; G=gravel; C=cobble; B=boulder
Cryptic= <31 mm of carapace length (CL); Juvenile= 31 mm to 69 mm CL; Adult= >69 mm CL

Another important aspect for a successful settling process is growth, which is highly influenced by temperature. To molt from stage IV to V, postlarval lobsters need temperatures of at least 10°C. Hence, it is paramount to release stage IV lobsters in the appropriate temperature regime. Temperature data were collected every 2 hrs using electronic recorders at 2 m, 3 m, 4 m, and 10 m on rocky habitat between 1990 and 2002. Temperature profiles at depths ranging from 3 m to 5 m show that bottom temperature reaches 10°C and stay at that temperature from early June to mid-October. However, 10°C is observed between early July and mid-October at a depth of 10 m. Hence, it is recommended to release hatchery-reared animals after June.

It was not possible to identify specific nursery areas for lobsters to release hatchery-reared stage IV. However, natural settlement of stage IV lobsters will only be possible where water temperature can reach 10°C for a given period time. Hence, to maximize the survival of hatchery-reared stage IV lobsters they should be released between July and August in "lobster-nursery-type-area", characterized as any rocky habitats (boulders-cobbles-gravel) at depths of less than 10 m.

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FISHERIES & AQUACULTURE UPDATE

Ventless Trap Survey of American Clawed Lobster in New England

From Trisha Cheney, Carl Wilson, & Melissa Smith

The peer review report for the 2005 American clawed lobster (*Homarus americanus*) stock assessment identified inadequate data as the primary limitation for proper management of this iconic species. To address this need, a cooperative random stratified ventless trap survey was designed to generate accurate estimates of the relative abundance and spatial distribution of lobster length frequency while attempting to limit the biases identified in conventional fishery dependent surveys. This study was funded by grants proved by the National Marine Fisheries Service and the Atlantic States Marine Fisheries Council.

Traps were placed at randomly chosen locations and depths (1-20 m, 21-40m & 41-60m); 3 ventless and 3 vented traps. A total of 148 stations were randomly selected and visited twice monthly during June, July, and August from Maine to New York (Fig. 1). A total of 19,525 lobsters, 9,089 Jonah crabs and 6,345 rock crabs were observed in a total of 2,544 trap hauls. Catch rates were substantially higher in ventless traps, than standard traps with vents, due to the higher retention of sublegal lobster (under 83 mm) by ventless traps (Fig. 2). In Maine waters, 95% of the lobsters caught in ventless traps were below legal size limit (83 mm) (Fig. 3). Catch rates were higher in eastern Maine than in western Maine, which is contrary to prior published results (Fig. 2). Maine catch rates were on average higher than states to the south that ran parallel surveys (Fig. 1 & 2). Catch rates of lobsters caught north of Cape Cod decreased from shallow to deeper water, while catch rates south of Cape Cod were higher in deeper waters (Fig. 4). This may be due to water being mixed in the northern Gulf of Maine, whereas water is stratified and much warmer in the shallow waters south of Cape Cod resulting in a high stress environment for lobsters. This study was conducted again this past summer during the months of June, July and August

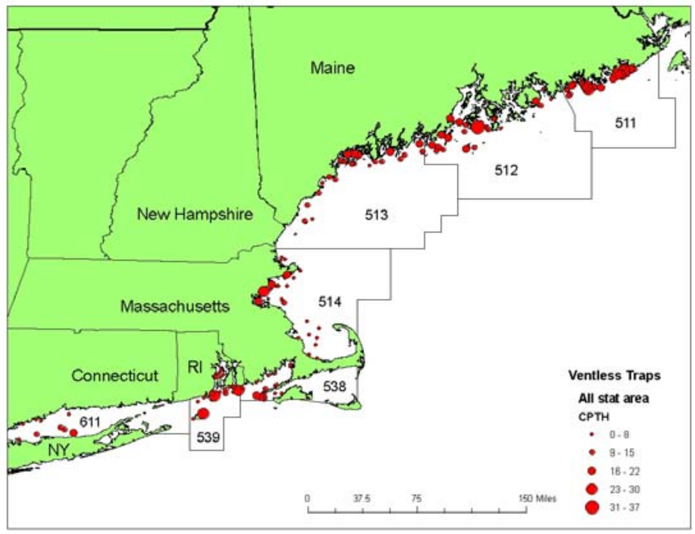

Figure 1. . Catch rates for lobsters caught in ventless in Maine (511, 512 & 513), Massachusetts (514 & 538), Rhode Island (539) and Connecticut/New York (611) from the 2006 survey.

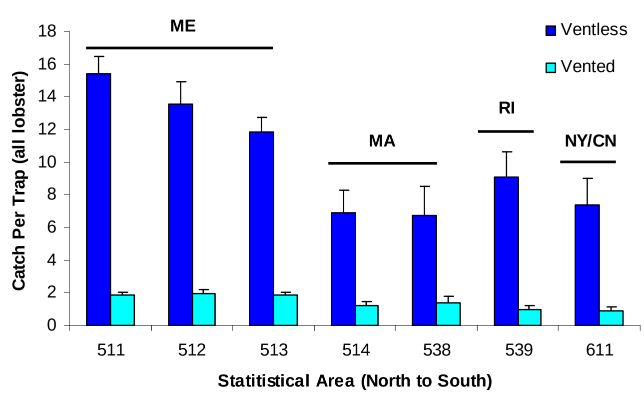

Figure 2. Catch rates of lobsters in ventless and vented traps in the near shore statistical areas.

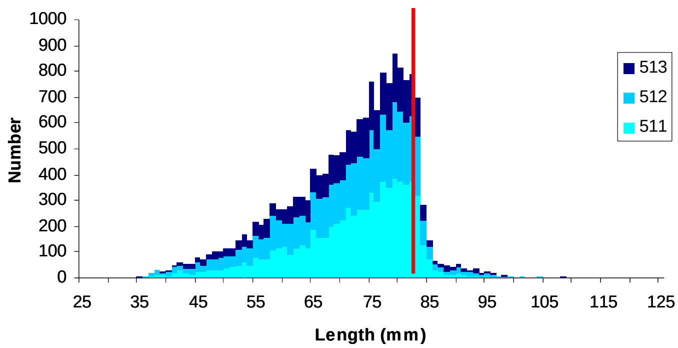

Figure 3. Ventless trap lobster carapace length frequencies by NMFS Statistical Area for all three months (June, July and August) over all depths in Maine water. Note the line is legal size limit.

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Berried American Lobster from Commercial Traps: a Pilot Study

From Carl MacDonald

In February 2007, we began a study regarding berried female lobsters (*Homarus americanus*) in LFA 34 in Southwestern Nova Scotia (CANADA). We requested that fishermen measure and record their catch of berried females (Fig. 1) from their commercial traps with sampling conducted by different fishermen fishing inshore, midshore, and offshore. The elected LFA 34 port representatives were solicited to find three fishermen to participate in the study from their port cluster. In total, we were looking for 45 fishermen to participate.

The fishermen involved were asked to measure the berried lobsters they caught with a measuring device provided and record the lobsters into three broad size groups (Fig. 1): small (less than 91mm), medium (91 to 120mm) and large (greater than 120 mm) berried lobsters. The measuring device is color coded to aid in the grouping of the berried females; small (silver), medium (red), and larger (blue). Along with recording the berried females caught, the participating fishermen documented the number of trap hauls and indicated the grid number where they fished.

Figure 1: Berried Homarus americanus (left) and measuring device used by fishermen (right)

Thus far, we have received 18 of 45 record books that were distributed. At this time, the data collected concentrates on the mid and inshore areas from Digby Neck to Cape Island (Fig. 2).

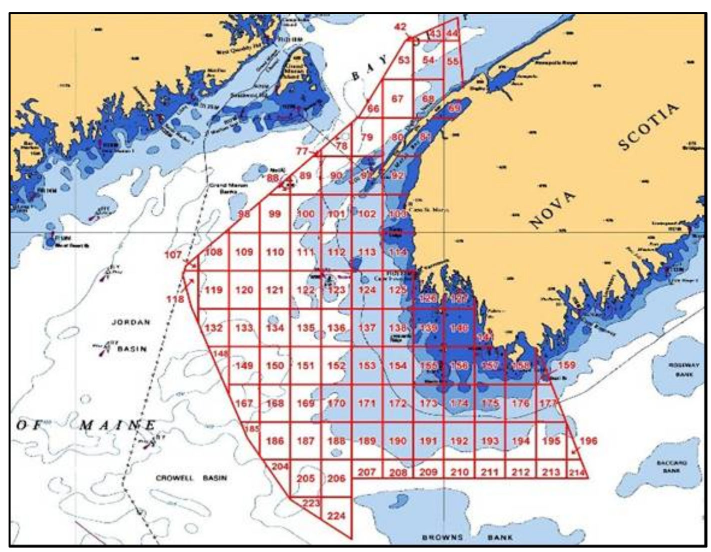

Figure 2: Study area south of Nova Scotia (CANADA), fishing grids (in red), and shaded grids where fishermen collected lobster data.

From the 18 record books returned, a total of 3820 berried lobsters were measured and recorded by the fishermen during the months from February to the end of May. In total, there were 201,390 trap hauls and approximately 1 berried lobster for every 50 trap hauls (Fig. 3). The majority (67%) of the berried females were in the 91-120mm size grouping (3 9/16 inches to 4 ¾ inches). This size distribution of berried females is similar to data collected by technicians while at sea on lobster vessels. Preliminary analysis shows that in February - March highest catch rates of berried females were in the mid to offshore areas. In May, the highest catch rates of berried lobsters were in the inshore grid areas, suggesting movement of berried lobsters from offshore to inshore. However, tagging studies may be necessary to confirm this.

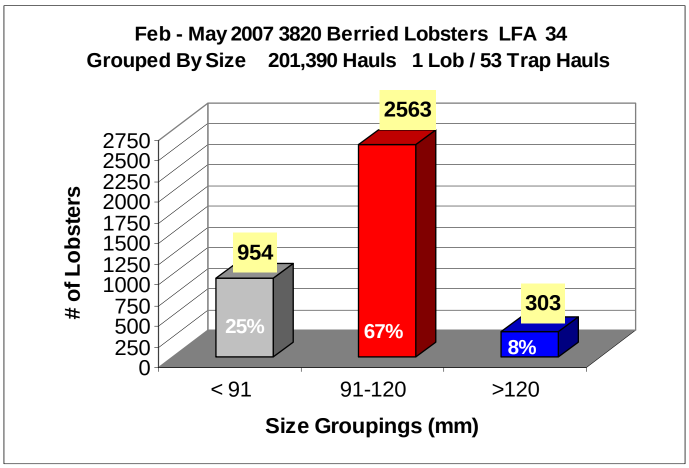

Figure 3: Data collected by 18 fishermen in LFA 34, Feb-May 2007.

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Shell Disease in Captive American Lobsters (*Homarus americanus*) Caught in Norwegian Waters

From Gro I. van der Meeren

American clawed lobsters (*Homarus americanus*) were found for the first time in Norwegian water in November 1999. Two females, one berried, were captured in the inner Oslofjord (van der Meeren et al. 2000; 2005). These two lobsters, along with some more captured the following year, were placed in local aquaria as part of an awareness campaign to educate the public about the problems of introduced species and to assist fishermen in keeping a look out for more specimens. Since 2000 fishermen have reported "strange-looking" lobsters to the Institute of Marine Research and many were run through a genetic test to certify the species identity (Jørstad et al. 2006)(Fig. 1). By the end of 2006, 16 specimens collected along much of the southern Norwegian coast have been positively identified as *H. americanus* (Jørstad et al .2006; 2007). Another *H. americanus* came from Denmark last winter, and some new possible cases from Norway were tested for 2007 (Agnalt, pers. com).

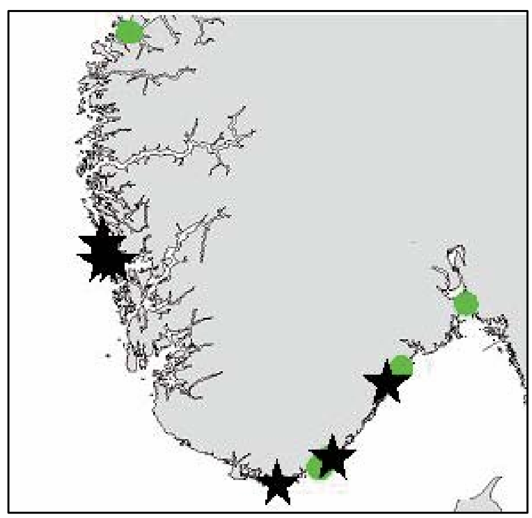

Figure 1. Confirmed collection of *H. americanus* in Norway through DNA-analysis. Circles are registrations in 2000 to 2004 (in total four), and stars are registrations in 2005 (eight of which five near Bjorøy in Hordaland county (from Jørstad et al. 2006).

In October 2007, I visited Risør Aquarium in southeast Norway; it is one of the holding facilities for American lobsters captured in Norway. They had no live specimens, only one old exoskeleton still on exhibition – the remains of a female American lobster (94 mm carapace length (CL)) captured in the Oslofjord in September 2000. Mr. Arild Eek, of Risør Aquarium, told us that it was kept in the exhibition tank, in flow-through water with ambient temperature, until it died within one year. He also told that the exuvia deteriorated dramatically in the months before the lobster died, developing numerous dents and soft spots (Figure 2a,b) – suspiciously similar to symptoms reported from shell disease.

Figure 2. Whole exuvia (2a) and close-up of carapace (2b) of the dead American lobster on display in Risør, Norway, October 2007. It was captured in the Oslofjord in September 2000. Scale in picture is in cm. (Photos: Terje van der Meeren, Institute of Marine Research)

The size, sex and position for the American lobsters captured in Norwegian waters detected for the first time in Norwegian, are all registered and filed at the Institute of Marine research, in Bergen, along with other measurements, egg status for females and some description on morphology. In none of these data is shell problems been noted.

I then contacted Mr. Tore Eriksen at the Drøbak Aquarium, who reported that one of the American lobsters he kept in his exhibition had the same shell problems, but was still alive after 7 years. In fact, this individual was that very first American lobster collected in Norwegian waters back in November 1999. It has never molted, unlike the European lobster (*Homarus gammarus*) with which it is sharing a tank, and its shell is soft and pockmarked with numerous dents (Fig. 3). Pictures and descriptions were sent to Kathy Castro (USA) for distribution among the researchers involved in the program to investigate in lobster shell disease along the northeastern coast of America. It was confirmed that the damage to the shell looked very much like shell disease.

Figure 3. Chela of live American lobster, living in a tank in Drøbak Aquarium, Norway since it was captured close by in November 1999. (Photo Tore Eriksen, Drøbak Akvarium)

Although there are some obstacles hindering our further investigation into the incidence of shell disease in *H. americanus* in Norway (e.g., the public aquarium want to keep their lobsters on display), we hope to collaborate in the near future with Dr. Castro and others from the USA who have experience with lobster shell disease. If you have knowledge of similar situations or interest in this problem, please contact me.

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MEETING REVIEWS

The 8th International Conference & Workshop on Lobster Biology and Management: A Graduate Student Perspective

From Victoria Burdett-Coutts

The opportunity to attend a scientific conference is a must do for any graduate student. The process of deciding which conference to attend can be a difficult one, primarily driven by topic and perhaps secondly by location – it is an excellent opportunity to make contacts and see new places. The 8th international conference and workshop on lobster biology and management was such an opportunity. Hosted this year in Charlottetown, the quant capital of Prince Edward Island, Canada provided opportunity to introduce some Eastern Canadian maritime flavour. A conglomerate of scientists, fishers, and managers from around the world would certainly prove interesting – all essentially working on the same subject but from different angles and with different objectives. Due to the infrequency of its occurrence, every 4 years, it's a must do for any graduate student no matter what stage of their research project. Whether you come to present an oral presentation or a poster, or merely as a bystander – the collection of scientists and students is an exciting occurrence.

The festivities began on a Sunday night, sponsored by a local microbrewery, whose pub would quickly become the local hang out and assortments of seafood. Beginning with socializing is apparently a common phenomena of conferences – good idea. The background chatter of various accents, and at times languages eluded to the diverse representation of 'lobster people' from around the globe. Being my first lobster conference I quickly began to recognize the names on tags from the countless papers we read when determining the direction and questions of graduate work – and for a split second of anxiety and excitement it feels like being at the Oscars – the friendly faces and approachability of the 'big wigs' quickly erupts into interesting discussions interrupted by the excitement of diverse array of hor dorves. For those who were 'regulars' a look of familiarity and many I'm sure thinking – has it really been four years.

The week seemed to disappear very quickly, dashing between conference rooms – having to decide which talks to attend – and the desire at times to be able to split oneself into a clone. Taking notes, getting ideas and inspiration, tracking people down between and after talks for further discussions – this conference stuff is hard work. The retirement of Dr William Hernnkind, a godfather of spiny lobster research, was a central focus of the conference – a respectful and somewhat humorous congratulation and appreciation of a lifetime of dedication and very relevant work. Things rarely seemed to finish with the last talk of the day and 'lobster people' soon began to accumulate in a local pub, 'The Gahan', who made their own beer. Conversation would continue within clusters to discuss various topics no doubt feeling compelled to stay longer to sample the diverse and tasty array of locally brewed beer. In a group that believes replication is required for scientific integrity this did indeed lead to a couple of late nights.

The opportunity to be a tourist occurred mid week – a perfect plan to give the lobsterites an opportunity for a break, to recognize life outside of lobsters, and to enjoy a beautiful sunny 20 + day either exploring independently, or joining one of the various tours such as kayaking or biking. Both groups I understand had a blast although many of the bikers took the bus on the return trip, and kayakers had to be in a double, coordinating the paddle ensured good team work skills – and for some – who had to work together – even though their countries were recently in a slam dunk rugby match led to many laughs post paddle. PEI is a beautiful province to travel and experience famous for various attractions such as beaches, biking paths, ocean activities, and of course delicious lobster.

The final night was the banquet where the delicious clawed lobster was served. The delight of many of us in the reality of getting to enjoy a tasty meal of the creature we passionately study I'm sure many a lobster person was drooling in the wait for the table by table coordination up to the enormous and impressively stacked samples of cooked lobsters to feed the 250 + attendees. The night was a grand success and recognition of the amount of dedicated time that goes into organizing such a conference was evident, for all the minute details that were considered and thought out – a great thank you to Jean Lavalli and the others in the Lobster Science Centre involved in its coordination. Throughout the conference they were seen to be running back and forth ensuring that all the behind the scenes conference aspects would allow us attendees to enjoy. The night however did not end there and many followed on to get down and dancy on the floor of another local pub where the dancing heads of a wide array of scientists grooving to various tunes was a not to be missed sight.

Friday yielded a somewhat more subdued crowd, five days of information can lead to overload – and many had either long drives or flights home. Closing ceremonies acknowledged the hard work of the hosts who passed the torch on to Norway – who will host the 9th annual conference in 2011.
So the conference came to a close, many good-byes and see you the next time around – all in all a fabulous experience – filled with new ideas and opportunities. The brain storming power of a large number of scientists coming together is a very cool event – for a nubee at least. People being very willing to share ideas and provide constructive comments, as well as the opportunity to see the other research that is up and coming in a very similar and relevant field world-wide. Job well done to the organizers – and – a round of applause to those that participated in the conference – combined – led to an experience for many – whether new on the scene or a repeat occurrence – each conference I'm sure has its own flavor and personality and this was superb.

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Participants of the 8th ICWL held on Prince Edward Island, CANADA September 2007

Meeting Summary: "Turning the tide of lobster enhancement - a critical discussion of enhancement efforts"

From Michael Tlusty and Rick Wahle

Nearly 100 years ago, the famous lobster biologist Herrick assessed the state of the North American lobster (*Homarus americanus*) fishery, and concluded with the following recommendations:
Adopt a double gauge or length limit
1. *Protect the "berried" lobster on principle*
2. *Abolish the closed season if it still exists*
3. *Wherever possible, adopt the plan of rearing the young to the bottom-seeking stage before liberation*
4. *License every lobster fisherman, and adopt a standard trap or pot which shall work automatically, so far as possible, in favor of the double gauge*

While these five points have each been addressed, #4 - rearing larvae, remains the elusive recommendation as until recently, there has been a lack of demonstrated success in rearing lobsters with positive impacts on populations or the fishery. This lack of success is not for a lack of trying, as up to 30 hatcheries were operational in eastern North America during the last century. To this day, enhancement efforts continue and one group - *The Homarus Group* in Shippagan, New Brunswick (CANADA) – has shown that a pulse of lobsters reared and returned to the wild could still be detected three years post-release.

On 18 December 2007, 24 participants met at the New England Aquarium to discuss the present day status of North American lobster enhancement efforts. Presentations were provided on current rearing efforts by Martin Mallet of *The Homarus Group* and Ted Ames of the *Zone C Hatchery*. Efforts on tracking the released lobsters were described by Rick Wahle of Bigelow Laboratory and Michel Comeau of Division of Fisheries and Oceans, New Brunswick. Diane Cowan of *The Lobster Conservancy* provided an overview of natural settlement of lobsters in the intertidal zone, while Stan Cobb educated the group with a historical view of FH Herrick's work at the turn of the 19th century.

Our ability to rear lobsters to the 4th stage and beyond is well developed, however, the most effective manner in which to do so is subject to debate. The currently favored production systems rely on live algae and brine shrimp (*Zone C Hatchery*), frozen food and dry feed (New Brunswick), or via modifications of the enclosure system described by Herrick (Beal Island) in which natural zooplankton are consumed. All are labor intensive efforts and the current cost per postlarva is ~ $0.75 to $1.00US. The goal of *The Homarus Group* is to produce postlarvae for $0.25 each. The rearing system is critical, as questions were raised about the overall health of the animals being released. Thus more work needs to define the health and probability of survival of post-settlement lobsters released into the wild, including bacterial, pathogen, and behavioral assessments. Health assessment must also be tied to cost-effectiveness and risk assessment. Mallet offered that limiting the time in the hatchery will minimize "artificial" impacts on the lobsters, recent work suggests that artificial feeds for larvae can cause carry-over effects into stages IV-VI (Fiore and Tlusty 2005). The NB group is evaluating how artificial feed regimes influence larval condition and behavior (Thériault and Pernet, in press).

Superficially, it appears that the fate of the released animals is different between NB and Maine, yet the two programs differ in many aspects making comparisons difficult. In NB, Comeau el al. observed a pulse of cohorts (released as 4th stage) 2 and 3 yrs after release, with animals appearing to move into nearby sites after 2 yrs. During the first releases of stage 4 larvae in Maine during 2006, the pulse of lobsters was consistently lost one day after release, but stage 5 releases proved more promising. Switching to releases of stage 5 larvae in 2007 were more productive; lobsters from those releases have been recovered out to 2 months later. Visual surveys were used in NB, while in Maine suction sampling was used (smaller spatial scale, but higher lobster size resolution). Discrepancies also exist in the reporting of the data. Maine larval releases and surveys are in cobble habitat, so density is expressed solely for this habitat, whereas the NB group assesses more habitat types on the order of km^2. Another factor is the natural suitability for the environment to support newly settled lobsters. The third year after the NB release, natural settlement increased greatly, and thus environmental parameters may have been suitable for newly settled lobsters at the time the NB animals were being released. Rick Wahle and Diane Cowan explained that in many areas of Maine, there were an abundance of larval settlers, but this did not appear to be the case in inner Penobscot Bay, Maine where the Zone C lobsters were placed.

The discussion turned to natural settlement, and the question if there are limitations based on resource availability, maximal densities, or other biotic and abiotic factors (temperature, predators, etc). For example, eastern Penobscot Bay has relatively poor settlement and local fishery landings per unit coastline have been less productive than the regions immediately to the west. It is likely the coastal circulation, namely, the Eastern Maine Coastal Current, starves eastern regions of a larval supply and enriches Maine's midcoast. A better understanding of larval source–sink dynamics is necessary.

As it currently stands, enhancement efforts are augmenting natural populations by a very small percent. Comeau estimated that in 2004 there were 5.4×10^6 natural settlers in North East NB, and 53,000 stage IV were released. Ted Ames estimated 1.5×10^9 larvae and 16×10^6 settlers in the Gulf of Maine. Thus the overall impact of current enhancement programs will be a tiny fraction of the total population. Yet, even with this small production, concerns were raised about the genetics implications of an enhancement program based on a small number of females. *The Homarus Group* utilized approximately 600 females in their enhancement program and kept them segregated by area. This was lauded as a good start, but did not dispel all concerns.

Substantial time was also devoted to the discussion of tools that may be useful in determining the success of any enhancement program. The genetic work conducted by Towle and Gerlach using genetic finger printing was offered as a way to genetically distinguish enhanced lobsters. In 2008-2009 Wahle and Gerlach will be undertaking a Sea Grant project to explore the utility of genetic fingerprinting approaches as a tool to distinguish hatchery from wild stock. If successful this approach would sidestep the prohibitive undertaking of tagging hundreds of thousands of lobsters and thereby streamline the process of evaluating the impact of hatcheries. The utility of microwire tags were also discussed, and while of limited utility in assessing the initial success of the IV lobsters, once the lobsters have grown, this is a feasible method to track the older animals, as demonstrated by Cowan in Maine (see also Bannister and Addison, 1988, Bull Mar Sci 62:369-387). No other appropriate marking technologies appear to be currently available.

Questions still surround the efficacy of American lobster enhancement. While the experimental seeding site in New Brunswick demonstrated a positive effect, this success has not yet been demonstrated elsewhere. Ted Ames eloquently pointed out that enhancement was a tool to recover subunits of a system, and the goal was to work toward restoration of the functional system without harming other subunits. Thus in terms of next steps, the populations most in need of enhancement need to be identified and long term monitoring of larval settlement established throughout the species range to better elucidate the source-sink question and identify the factors driving settlement (temperature, high level atmospheric influences) and areas where natural recruitment is sufficient and should be allowed to operate without enhancement. Guidelines must also be developed for enhancement work. Enhancement "standards", "Best Management Practices", criteria for defining health of potential releasees, and the operational goals of the programs need to be developed. It was suggested that "restoration of damaged populations" be the refocused goal of current programs.

Finally, it is clear that increased communication needs to occur between the groups represented here, as well as other crustacean enhancement efforts. Brad Stevens provided ample experience from development of a stock enhancement effort with the blue crab in the Chesapeake and many issues experienced in that endeavor are germane to the American lobster.

In summary, the success of the Homarus group in New Brunswick has offered optimism that hatchery reared lobsters can be successfully released and survive. It has not yet been determined if these animals will recruit to the fishery. This optimism needs to be tempered by the large number of questions still surrounding this body of work. It is unknown whether these efforts will be successful everywhere, and furthermore, it is important to clearly define the criteria by which we measure success. Furthermore, a full risk-assessment has yet to be conducted, and in particular, are there deleterious effects on healthy populations. Work needs to be directed at determining program outcomes, and standards relating to program quality and best management plans.

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AMUSEMENTS

Are You in the Book of Lobster World Records?

From Win Watson

Every baseball fan recognizes the magical numbers 56, 61 and 715. Basketball fans are enamored with 23 and 100. Pele's number 10 jerseys still fetch thousands at auctions. Most Americans alive today react to 9/11 and SciFi connoisseurs have been raised on 1984 and 2001. But what about lobster scientists?

Soon 18, 117 and 217 will be etched in our brains. Next time you sit down to eat a lobster you won't be able to avoid thinking about Ehud Spanier eating 18 different species of lobsters in his career. When you pull up your next trap and joke that it must be so heavy because it is full of lobsters, think of Sara Ellis sorting through 117 of them from one ventless trap. Think that jumbo American lobster in the local aquarium is big? Try pulling up a 217 mm CL male while SCUBA diving (I think it was actually larger than Peter Lawton). How can you possibly forget these milestones?

Are you worried you will? Me too. So, I am creating a repository for these interesting facts and figures, The Lobster Book of World Records (actually, it will be a website soon). Since the International Lobster Conference in PEI this fall, records have been pouring into our office. However, there is no doubt that we are only dealing with the tip of the iceberg. The purpose of this article is to urge you to help me expand and refine the Record Book. All records you submit should have some type of validation (testimony from dive buddy, reference, Xerox of page from data book, etc.). We welcome pictures of records as well as record holders, to enhance the website.

Below is just a small sampling of the records we have and the types of records we seek. As an indication of how easy it is for you to get into the record book, even Stan Cobb managed to sneak into the Book with the following record: most lobster legs eaten by rats, 150.

Please send all suggestions, records, pictures and complaints to: win@unh.edu (Win Watson, University of New Hampshire).

Selected Current Records and "unfilled" Records that Beg for Your Input:

Eating

- Most lobsters eaten at one sitting:
  10. Ehud Spanier. 1995
  Honorable Mention: 7, Grabowski
- Most lobsters consumed by a professional: 38 in 12 min, The Black Widow
- Biggest and Smallest Lobster eaten?
- Has anyone ever eaten lobster eggs?

Animals

- Smallest clawed lobster egger:
  52 mm CL, *H. americanus*; Carl Wilson
- Smallest spiny lobster egger:
  32 mm CL, *P. guttatus*; Denice Robertson
- Longest distance traveled by a lobster:
  800 kms, A. Campbell.
- Longest time between tag and recapture:
  9 years, Jay Krouse (What about shortest?)
- Longest distance traveled in a day?
- Worst case of shell disease?
- Most fouled live lobster?
- Strangest species found with lobster in gut? Also largest and smallest?
- Strangest species/object found in lobster stomach?

Publications

- Most species in one paper: 22 Ehud Spanier
- Worst conditions experienced while writing a paper:
  Peter Lawton, laundry room of ship while writing chapter for Biology of Lobsters.
- Longest time to write a paper, from start to finish?
- Longest time between first data point and last data point collected, but not during a time-series project:
  11 years*, Jan Factor (*Data must be published).
- Worst/Best review of a paper or grant.
- Most submissions/rejections before a paper is published.
- Largest and smallest number of subjects/animals in paper?
- Shortest/longest paper?
- Most authors on one paper?
- Most complex figure.
- Greatest contribution to science by a single lobster.
- Least/most cited papers.
- Most expensive published study. Cheapest?

Catch/Collecting/Experiments

- Most phylogenetically distinct species captured in one handnet: 1 human (Bill Herrnkind's head) and one spiny lobster. Mark Butler. 1989.
- Most Homarus PLs captured in 15 minute tow: 198, Stan Cobb
- Most postlarval spiny lobsters caught in 20 min tow: 293 (*P. argus*) Mark Butler 1988
  Honorable mention: 67 (*P. argus pueruli*) (Jason Goldstein and Peter Bouwma).
- Great number/biomass in single transect: 170 large females, Peter Lawton.
- Most animals handled while sea sampling in 1 day: 2000, David Robicheau.
- Longest single research dive: 3 hours, Tom Langley
- Most lobsters in a trawl: 3,982 or 194/min, Carl Wilson, 1998.
- Most recaptures of one animal: 7, Carl Wilson
- Most collecting dives in a year: 210, Cindy Lewis
- Most lobsters captured in a single attempt: 7, Don Behringer
- Largest lobster captured diving: 217 male, 207 berried female, Peter Lawton.
- Largest spiny lobster captured diving: 180 mm, Cindy Lewis.
- Most southern *H. americanus* captured/documented: Miami Beach, 252 meters (Stephen V. Cofer-Shabica and Richard Nielson, Bull Mar. Sci. 43: 315-317, 1988).

- Deepest documented settlement of H. americanus: 85 m, Rick Wahle, 2007
- Furthest north settlement of H. americanus: Newfoundland, Rick Wahle
- Longest time spent videotaping a dead lobster: 48 hour time lapse, Steve Jury, 1999.
- Deepest lobsters captured/observed?
- Most lobsters captured in a standard trap?
- Most severe injury sustained while collecting: Bill Sharp, fire-coral, sensitive area of male anatomy, while wearing only spandex. No picture is being requested.
- Highest density of lobsters documented in one area?
- Shortest research dive?
- Deepest research dive on a single tank?
- Most lobsters captured or tagged in a single dive?
- Most expensive piece of equipment lost or destroyed during dive/trip?
- Lowest/highest recapture rate in tag/recapture study?
- Cruelest death capture on video?
- Most appendages missing from lobster captured in their natural habitat?

Catch/collecting commercial division

- Most lobsters captured by one boat in a day?
- Most lobsters held in one facility at one time?
- Most lobsters captured in one string?
- Furthest shipment of lobsters for scientific purposes: USA to Japan (via Florida Keys --> Miami, Florida --> Memphis, Tennessee --> Anchorage, Alaska --> Osaka, Japan, Mie, Japan), 27 hours (Jason Goldstein, Mark Butler, and Hirokazu Matsuda).
- Most traps hauled in a day?
- Longest/most traps on a single string?
- Most traps in water at one time by one boat?

Career Achievements

- Only PhD involving lobsters in Norway: Gro van der Meer-2003.
- Longest to complete Masters Degree: 10 years Barbara Somers
- Longest time to complete PhD?
- Most graduate students mentored in a career?
- Most career publications about lobsters?
- Most lobster species published, counting no more than one species per paper?

Meetings

- Bawdiest song, sung at a conference: Peter Lawton-2007.
- Largest International Conference & Workshop on Lobster: 221 participants, 2000 Conference in Key West, Florida

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The distinguished Professor Win Watson (right) and his doctoral student, Jason Goldstein (left) revealing a new record at a local establishment following the formal sessions at the 8th ICWL on Prince Edward Island, Canada in September 2007.

The Lobster NEWSLETTER

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