

# Aspiring to an altered stable state: rebuilding of bay scallop populations and fisheries following intensive restoration

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## Supplement 1.

Table S1. Sampling sites of natural bay scallop *Argopecten irradians irradians* populations in the Peconic Bays, New York, USA, 2005-2012. Bottom type—S = sand; M = mud; MS = muddy sand; Sh = shell hash; Ma = macroalgae; Cf = *Crepidula fornicata* barrens; Gr = gravel; E = eelgrass. SAV cover was estimated visually by divers in 50 x 1 m transects, from 2009-2012: Cod = *Codium fragile*, eel = *Zostera marina*, Spy = *Spyridia filamentosa*, Grin = *Grinnellia americana*

### Orient Harbor

| Site Name          | Latitude    | Longitude   | Depth (m)<br>at MLW | Bottom Type | Range in SAV<br>Cover (%) | Dominant<br>SAV | Relative<br>Current Flow |
|--------------------|-------------|-------------|---------------------|-------------|---------------------------|-----------------|--------------------------|
| East Marion        | 41°07.714'W | 72°19.641'W | 1.3                 | S/Sh/Ma     | <1-37                     | Spy/Cod         | low                      |
| Longlines          | 41°08.282'N | 72°18.937'W | 4.5                 | M           | 1-80                      | Cod             | low                      |
| Peter's Neck       | 41°07.697'N | 72°17.521'W | 1.3                 | S           | <1-10                     | Spy             | high                     |
| Inside Long Beach  | 41°07.352'N | 72°17.532'W | 4                   | MS/M/Sh/Ma  | <1-25                     | Cod             | low                      |
| Outside Long Beach | 41°06.766'N | 72°17.682'W | 3                   | S/Sh/Cf     | 0-2                       | mix             | high                     |
| Central Orient     | 41°07.289'N | 72°18.296'W | 6.3                 | M           | <1                        | --              | low                      |
| Hay Beach          | 41°06.308'N | 72°19.555'W | 1.7                 | S/E/Ma/Sh   | 12-90                     | eel             | high                     |
| Greenport Jetty    | 41°06.347'N | 72°20.892'W | 3.5                 | MS/Sh/Ma    | 1-2                       | mix             | high                     |

### Southold Bay

| Site Name    | Latitude    | Longitude   | Depth (m)<br>at MLW | Bottom Type | Range in SAV<br>Cover (%) | Dominant<br>SAV | Relative<br>Current Flow |
|--------------|-------------|-------------|---------------------|-------------|---------------------------|-----------------|--------------------------|
| Southold Bay | 41°03.966'N | 72°24.203'W | 3                   | MS/Sh/Ma    | 0-1                       | Spy/Grin        | high                     |

### Hog Neck Bay

| <u>Site Name</u> | <u>Latitude</u> | <u>Longitude</u> | <u>Depth (m)<br/>at MLW</u> | <u>Bottom Type</u> | <u>Range in SAV<br/>Cover (%)</u> | <u>Dominant<br/>SAV</u> | <u>Relative<br/>Current Flow</u> |
|------------------|-----------------|------------------|-----------------------------|--------------------|-----------------------------------|-------------------------|----------------------------------|
| Hog Neck Bay     | 41°01.610'N     | 72°24.110'W      | 3                           | S/Sh/Ma            | 5-33                              | Cod/Grin                | high                             |

### Hallock Bay

| <u>Site Name</u>   | <u>Latitude</u> | <u>Longitude</u> | <u>Depth (m)<br/>at MLW</u> | <u>Bottom Type</u> | <u>Range in SAV<br/>Cover (%)</u> | <u>Dominant<br/>SAV</u> | <u>Relative<br/>Current Flow</u> |
|--------------------|-----------------|------------------|-----------------------------|--------------------|-----------------------------------|-------------------------|----------------------------------|
| Narrow River       | 41°08.197'N     | 72°16.840'W      | 1.5                         | M/Sh/Ma            | <1-30                             | Cod                     | low                              |
| Bulkhead           | 41°08.251'N     | 72°16.396'W      | 1.7                         | M/MS/Ma            | <1-95                             | Spy/Cod                 | low                              |
| John's site        | 41°08.287'N     | 72°15.799'W      | 1.7                         | MS/Sh/Ma           | --                                | Cod                     | low                              |
| Inside Little Bay  | 41°08.191'N     | 72°15.491'W      | 1.3                         | M/Sh/Ma            | --                                | --                      | low                              |
| Outside Little Bay | 41°08.012'N     | 72°15.824'W      | 2                           | MS/Sh/Ma           | --                                | --                      | low                              |
| Central Flats      | 41°07.951'N     | 72°16.389'W      | 1.7                         | S/Ma               | 0-20                              | Cod                     | low                              |
| S channel          | 41°07.766'N     | 72°16.273'W      | 2.6                         | M/Sh/Ma            | 3-60                              | Cod                     | high                             |

### Northwest Harbor

| <u>Site Name</u>  | <u>Latitude</u> | <u>Longitude</u> | <u>Depth (m)<br/>at MLW</u> | <u>Bottom Type</u> | <u>Range in SAV<br/>Cover (%)</u> | <u>Dominant<br/>SAV</u> | <u>Relative<br/>Current Flow</u> |
|-------------------|-----------------|------------------|-----------------------------|--------------------|-----------------------------------|-------------------------|----------------------------------|
| Offshore Cedar Pt | 41°02.099'N     | 72°15.349'W      | 2                           | S/Sh/Ma            | --                                | --                      | high                             |
| Inshore Cedar Pt  | 41°02.251'N     | 72°15.416'W      | 2.5                         | S/Sh/Cf/Ma         | 0-80                              | Cod                     | high                             |
| NE Corner         | 41°02.454'N     | 72°14.535'W      | 4                           | M                  | --                                | --                      | low                              |
| SWG               | 41°01.806'N     | 72°14.596'W      | 2                           | S/Sh/Ma            | <1-75                             | Cod                     | low                              |
| St. Regis         | 41°01.519'N     | 72°14.889'W      | 2.5                         | MS/Sh/Ma           | --                                | --                      | high                             |
| Barcelona Neck    | 41°00.873'N     | 72°15.389'W      | 3                           | MS/Sh              | 0-10                              | mix                     | low                              |
| E Sag Harbor      | 41°01.055'N     | 72°16.000'W      | 4                           | S/Sh/Ma            | --                                | --                      | high                             |
| Sag Harbor        | 41°00.410'N     | 72°17.419'W      | 2                           | S/Sh/Ma            | 1-40                              | Cod/Grin                | high                             |

### Great Peconic Bay

| <u>Site Name</u> | <u>Latitude</u> | <u>Longitude</u> | <u>Depth (m)<br/>at MLW</u> | <u>Bottom Type</u> | <u>Range in SAV<br/>Cover (%)</u> | <u>Dominant<br/>SAV</u> | <u>Relative<br/>Current Flow</u> |
|------------------|-----------------|------------------|-----------------------------|--------------------|-----------------------------------|-------------------------|----------------------------------|
| Robins Is North  | 40°58.989'N     | 72°27.811'W      | 2                           | MS/Sh/Ma           | 0-35                              | Cod                     | high                             |
| Robins Is West   | 40°57.704'N     | 72°28.190'W      | 3                           | S/Sh/Ma            | <1-10                             | Cod/Grin                | high                             |
| Mattituck        | 40°57.609'N     | 72°31.924'W      | 5                           | S/Sh/Ma            | 30-60                             | Cod                     | low                              |

**Flanders Bay**

| <u>Site Name</u>  | <u>Latitude</u> | <u>Longitude</u> | <u>Depth (m)<br/>at MLW</u> | <u>Bottom Type</u> | <u>Range in SAV<br/>Cover (%)</u> | <u>Dominant<br/>SAV</u> | <u>Relative<br/>Current Flow</u> |
|-------------------|-----------------|------------------|-----------------------------|--------------------|-----------------------------------|-------------------------|----------------------------------|
| S of Red Cedar Pt | 40°54.783'N     | 72°34.023'W      | 3                           | M/Sh/Ma            | 1-45                              | Cod/Grin                | low                              |
| Cow Yard          | 40°55.026'N     | 72°35.118'W      | 3                           | S/Sh/Ma            | 0-3                               | mix                     | low                              |
| North Side        | 40°55.719'N     | 72°36.325'W      | 2                           | M/Ma               | --                                | --                      | low                              |
| Planting site     | 40°54.690'N     | 72°34.087'W      | 2.5                         | MS/Sh/Ma           | 25-50                             | mix                     | low                              |

**Supplement 2.** Commercial bay scallop landings, 2008-2013, partitioned by New York State Shellfish Harvest Area (NYSDEC 2014). P = Peconic Bay areas, G = Gardiners Bay, N = Napeague area, other = South shore bays (including Shinnecock, Moriches and Great South Bays) and Long Island Sound.

Figure S1. New York State Department of Environmental Conservation Shellfish Harvest Areas.

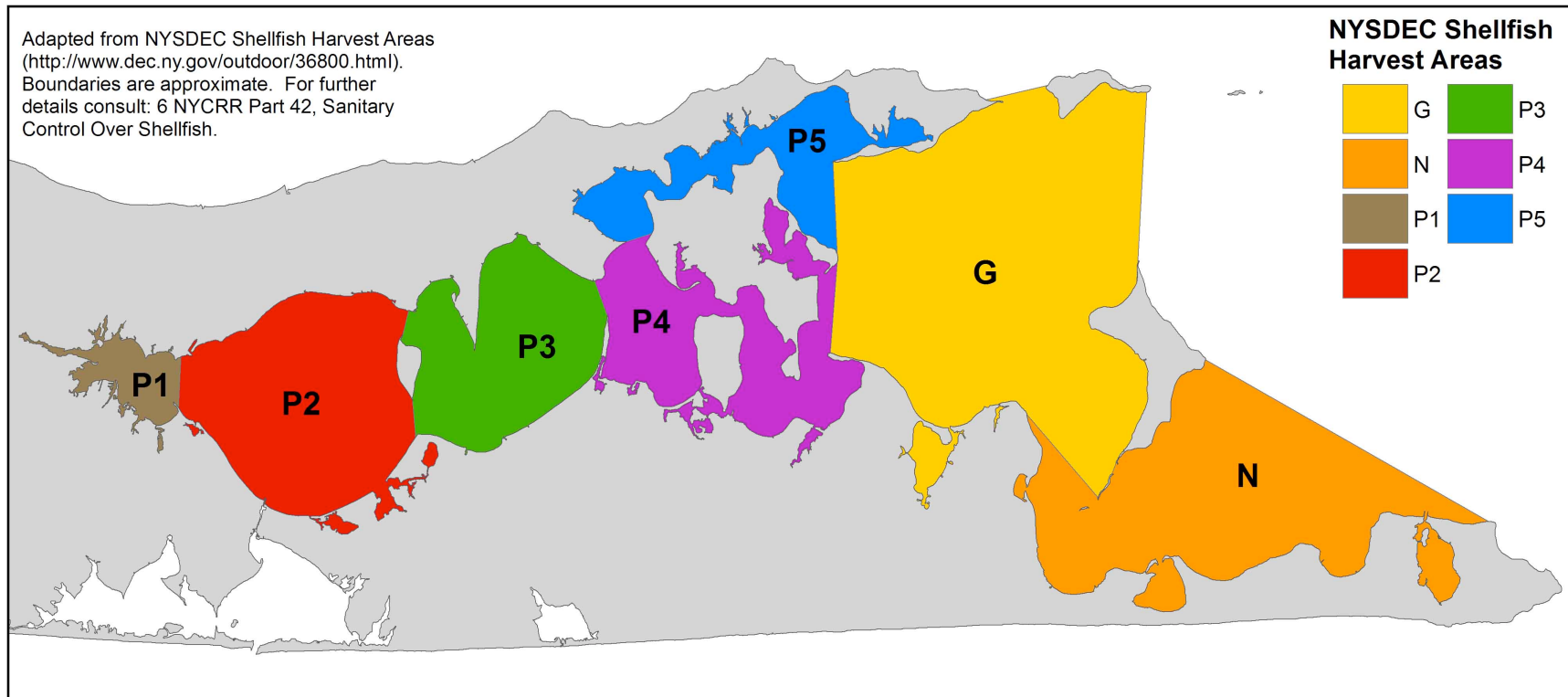


Table S2. Commercial bay scallop landings, partitioned by area (NYSDEC 2014). Landings prior to 2008 were categorized by Town, so landings often could not be attributed to specific bodies of water.

Commercial bay scallop landings (kg of meats) by harvest area

| <u>Year</u> | <u>P1</u> | <u>P2</u> | <u>P3</u> | <u>P4</u> | <u>P5</u> | <u>G</u> | <u>N</u> | <u>Other</u> | <u>Total</u> |
|-------------|-----------|-----------|-----------|-----------|-----------|----------|----------|--------------|--------------|
| 2008        | 42        | 854       | 2835      | 46        | 719       | 0        | 0        | 14           | 4510         |
| 2009        | 25        | 1928      | 2601      | 935       | 2947      | 0        | 0        | 35           | 8471         |
| 2010        | 0         | 9883      | 3852      | 2090      | 1161      | 549      | 733      | 56           | 18324        |
| 2011        | 20        | 5980      | 1215      | 2382      | 2099      | 488      | 447      | 492          | 13124        |
| 2012        | 54        | 4738      | 1586      | 1173      | 2191      | 266      | 5528     | 105          | 15641        |
| 2013        | 0         | 5334      | 1812      | 2847      | 2843      | 622      | 937      | 323          |              |

**Supplement 3.** Added value to Long Island, New York, USA economy due to increased commercial bay scallop landings following initiation of our restoration program

**A.** Commercial bay scallop landings and values for Peconic Bays (NYSDEC 2014)

| <u>Year</u> | <u>DEC reported landings (kg meats): Peconic Bays</u> | <u>Landings above 1512 kg average harvest for 1996-2007</u> | <u>DEC dockside price per kg (\$)</u> | <u>Dockside value (\$) above 1996-2007 average dockside value (unadjusted for inflation)</u> | <u>Total increase in seafood product revenue using 4.5x economic multiplier of Karney (1991)</u> | <u>Total increase in seafood product revenue using 9.98x multiplier of Kroeger (2012)</u> |
|-------------|-------------------------------------------------------|-------------------------------------------------------------|---------------------------------------|----------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------|
| 2008        | 4,496                                                 | 2,984                                                       | 36.38                                 | 108,553                                                                                      | 488,491                                                                                          | 1,083,364                                                                                 |
| 2009        | 8,436                                                 | 6,924                                                       | 31.97                                 | 221,342                                                                                      | 996,041                                                                                          | 2,208,998                                                                                 |
| 2010        | 18,268                                                | 16,756                                                      | 31.97                                 | 535,644                                                                                      | 2,410,400                                                                                        | 5,345,732                                                                                 |
| 2011        | 12,631                                                | 11,120                                                      | 31.97                                 | 355,453                                                                                      | 1,599,538                                                                                        | 3,547,421                                                                                 |
| 2012        | 15,536                                                | 14,024                                                      | 31.97                                 | 448,296                                                                                      | 2,017,334                                                                                        | 4,473,999                                                                                 |
| 2013        | 14,395                                                | 12,883                                                      | 31.97                                 | 411,814                                                                                      | 1,853,165                                                                                        | 4,109,909                                                                                 |
| Total       | 73,762                                                | 64,691                                                      |                                       | 2,081,104                                                                                    | 9,364,970                                                                                        | 20,769,423                                                                                |

**B.** Our estimated commercial bay scallop landings and values for Peconic Bays; see Methods for explanation

| <u>Year</u> | <u>Estimated landings (kg meats): Peconic Bays</u> | <u>Estimated landings above 3780 kg average harvest for 1996-2007</u> | <u>DEC dockside price per kg (\$)</u> | <u>Estimated dockside value (\$) above 1996-2007 average dockside value (unadjusted for inflation)</u> | <u>Estimated total increase in seafood product revenue using 4.5x economic multiplier of Karney (1991)</u> | <u>Estimated total increase in seafood product revenue using 9.98x multiplier of Kroeger (2012)</u> |
|-------------|----------------------------------------------------|-----------------------------------------------------------------------|---------------------------------------|--------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------|
| 2008        | 11,240                                             | 7,461                                                                 | 36.38                                 | 271,384                                                                                                | 1,221,227                                                                                                  | 2,708,410                                                                                           |
| 2009        | 21,090                                             | 17,311                                                                | 31.97                                 | 553,356                                                                                                | 2,490,103                                                                                                  | 5,522,495                                                                                           |
| 2010        | 45,671                                             | 41,891                                                                | 31.97                                 | 1,339,111                                                                                              | 6,026,001                                                                                                  | 13,364,330                                                                                          |
| 2011        | 31,578                                             | 27,799                                                                | 31.97                                 | 888,632                                                                                                | 3,998,846                                                                                                  | 8,868,552                                                                                           |
| 2012        | 38,840                                             | 35,060                                                                | 31.97                                 | 1,120,741                                                                                              | 5,043,336                                                                                                  | 11,184,998                                                                                          |
| 2013        | 35,986                                             | 32,207                                                                | 31.97                                 | 1,029,536                                                                                              | 4,632,913                                                                                                  | 10,274,772                                                                                          |
| Total       | 148,419                                            | 161,729                                                               |                                       | 5,202,761                                                                                              | 23,412,426                                                                                                 | 51,923,557                                                                                          |