

## 4.1 Assessment of the northern and southern rock sole (*Lepidopsetta polyxystra and bilineata*) stocks in the Gulf of Alaska for 2014

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### Executive Summary

Due to the government shut-down in October 2013, stock assessments for an abbreviated suite of model runs are required only for Steller sea lion prey species (walleye pollock, Pacific cod, Bering Sea/Aleutian Islands Atka mackerel), and species where a conservation concern has been noted. For all other Tier 1-3 stocks, updated projections from last year using 2013 catch data are required at a minimum. Results will be presented in executive summaries using the "off-year" format for stocks on biennial assessment cycles.

### Summary of results

The 2012 stock assessment document contains the most recent information for the full stock assessment (<http://www.afsc.noaa.gov/REFM/Docs/2012/GOAnsrocksole.pdf>).

### New information and projections

The biomass estimate from the 2013 GOA NMFS bottom trawl survey for northern rock sole was a slight increase (2.3%) from the estimate from the 2011 survey. The biomass estimate from the 2013 survey for southern rock sole was an increase of 9% from the estimate from the 2011 survey.

The catch totals for 2012 and 2013 for the shallow-water flatfish complex and rock sole were updated and used in the projections to obtain updated harvest specifications. The total rock sole catch for 2012 and 2013 was assumed to be split equally between northern and southern rock sole. No stock assessment models were run.

### Northern rock sole

| Quantity                             | As estimated or<br><i>specified last year for:</i> |             | As estimated or<br><i>recommended this year for:</i> |             |
|--------------------------------------|--|-------------|--|-------------|
|                                      | 2013   | 2014        | 2014   | 2015        |
| $M$ (natural mortality rate)         | 0.2,0.275*   | 0.2, 0.275* | 0.2,0.275*   | 0.2, 0.275* |
| Tier                                 | 3a   | 3a          | 3a   | 3a          |
| Projected total (age 3+) biomass (t) | 89,300   | 80,000      | 87,300   | 79,300      |
| Female spawning biomass (t)          | 42,700   | 36,500      | 40,600   | 34,400      |
| Projected                            |  |             |  |             |
| $B_{100\%}$                          | 50,300   | 50,300      | 50,300   | 50,300      |
| $B_{40\%}$                           | 20,100   | 20,100      | 20,100   | 20,100      |
| $B_{35\%}$                           | 17,600   | 17,600      | 17,600   | 17,600      |
| $F_{OFL}$                            | 0.180  | 0.180       | 0.180  | 0.180       |
| $maxF_{ABC}$                         | 0.152  | 0.152       | 0.152  | 0.152       |
| $F_{ABC}$                            | 0.152  | 0.152       | 0.152  | 0.152       |
| OFL (t)                              | 11,400   | 9,900       | 11,000   | 9,700       |
| maxABC (t)                           | 9,700  | 8,500       | 9,400  | 8,300       |
| ABC (t)                              | 9,700  | 8,500       | 9,400  | 8,300       |

| <b>Status</b>          | As determined <i>last</i> year for: |      | As determined <i>this</i> year for: |      |
|------------------------|-------------------------------------|------|-------------------------------------|------|
|                        | 2011                                | 2012 | 2012                                | 2013 |
| Overfishing            | no                                  | n/a  | no                                  | n/a  |
| Overfished             | n/a                                 | no   | n/a                                 | no   |
| Approaching overfished | n/a                                 | no   | n/a                                 | no   |

\* for males; estimated

### Southern rock sole

| <b>Quantity</b>                      | As estimated or<br><i>specified last</i> year for: |             | As estimated or<br><i>recommended this</i> year for: |             |
|--------------------------------------|--|-------------|--|-------------|
|                                      | 2013   | 2014        | 2014   | 2015        |
| <i>M</i> (natural mortality rate)    | 0.2, 0.267*  | 0.2, 0.267* | 0.2, 0.267*  | 0.2, 0.267* |
| Tier                                 | 3a   | 3a          | 3a   | 3a          |
| Projected total (age 3+) biomass (t) | 208,800  | 192,700     | 208,800  | 195,200     |
| Female spawning biomass (t)          | 82,800   | 72,500      | 81,500   | 69,300      |
| Projected                            |  |             |  |             |
| <i>B</i> <sub>100%</sub>             | 112,900  | 112,900     | 112,900  | 112,900     |
| <i>B</i> <sub>40%</sub>              | 45,100   | 45,100      | 45,100   | 45,100      |
| <i>B</i> <sub>35%</sub>              | 39,500   | 39,500      | 39,500   | 39,500      |
| <i>F</i> <sub>OFL</sub>              | 0.230  | 0.230       | 0.230  | 0.230       |
| <i>maxF</i> <sub>ABC</sub>           | 0.193  | 0.193       | 0.193  | 0.193       |
| <i>F</i> <sub>ABC</sub>              | 0.193  | 0.193       | 0.193  | 0.193       |
| OFL (t)                              | 21,900   | 19,300      | 21,400   | 18,900      |
| maxABC (t)                           | 18,600   | 16,400      | 18,200   | 16,000      |
| ABC (t)                              | 18,600   | 16,400      | 18,200   | 16,000      |
| <b>Status</b>                        | As determined <i>last</i> year for:                |             | As determined <i>this</i> year for:                  |             |
|                                      | 2011   | 2012        | 2012   | 2013        |
| Overfishing                          | no   | n/a         | no   | n/a         |
| Overfished                           | n/a  | no          | n/a  | no          |
| Approaching overfished               | n/a  | no          | n/a  | no          |

\* for males; estimated

Table 4.1 – Estimated catch (in metric tonnes) for shallow water flatfish (SWFF) and total rock sole catch from the Alaska Fisheries Information Network (AKFIN) (as of 2013-10-30).

| <b>Year</b> | <b>SWFF catch<br/>(AKFIN)</b> | <b>U/N/S rock<br/>sole catch<br/>(AKFIN)</b> | <b>% U/N/S<br/>rock sole</b> |
|-------------|-------------------------------|--|------------------------------|
| 1991        | 5,224.6                       | 0.1  | -                            |
| 1992        | 8,333.8                       | 42.0   | -                            |
| 1993        | 9,113.7                       | 8,112.1                                      | 89.0                         |
| 1994        | 3,843.0                       | 3,008.1                                      | 78.3                         |
| 1995        | 5,436.9                       | 3,923.9                                      | 72.2                         |
| 1996        | 9,372.4                       | 6,595.3                                      | 70.4                         |
| 1997        | 7,779.6                       | 5,466.8                                      | 70.3                         |
| 1998        | 3,567.3                       | 2,532.3                                      | 71.0                         |
| 1999        | 2,578.4                       | 1,765.4                                      | 68.5                         |
| 2000        | 6,928.7                       | 5,386.7                                      | 77.7                         |
| 2001        | 6,163.3                       | 4,771.7                                      | 77.4                         |
| 2002        | 7,177.3                       | 5,564.3                                      | 77.5                         |
| 2003        | 4,648.5                       | 3,554.6                                      | 76.5                         |
| 2004        | 3,094.2                       | 2,216.7                                      | 71.6                         |
| 2005        | 4,805.1                       | 4,130.5                                      | 86.0                         |
| 2006        | 7,651.7                       | 5,763.3                                      | 75.3                         |
| 2007        | 8,692.0                       | 6,727.4                                      | 77.2                         |
| 2008        | 9,725.9                       | 7,269.1                                      | 74.7                         |
| 2009        | 8,485.0                       | 6,538.7                                      | 77.1                         |
| 2010        | 5,533.7                       | 3,285.3                                      | 59.4                         |
| 2011        | 3,990.8                       | 3,094.4                                      | 77.5                         |
| 2012        | 4,022.7                       | 2,828.6                                      | 70.3                         |
| 2013        | 4,974.3                       | 3,667.2                                      | 73.7                         |

Table 4.2 – Fishery observer extrapolated catch (based on sampled catch) in metric tonnes (as of 2013-10-30) for undifferentiated (U), northern (N), and southern (S) rock sole, and shallow water flatfish (SWFF)

| <b>Year</b> | <b>U rock sole</b> | <b>N rock sole</b> | <b>S rock sole</b> | <b>SWFF</b> | <b>%SWFF catch observed</b> |
|-------------|--------------------|--------------------|--------------------|-------------|-----------------------------|
| 1990        | 1,260.9            |                    |                    | 1,500.0     | 18.8                        |
| 1991        | 1,285.8            |                    |                    | 1,458.6     | 27.9                        |
| 1992        | 2,005.5            |                    |                    | 2,321.4     | 27.9                        |
| 1993        | 1,117.1            |                    |                    | 1,373.7     | 15.1                        |
| 1994        | 409.0              |                    |                    | 662.2       | 17.2                        |
| 1995        | 810.0              |                    |                    | 1,067.6     | 19.6                        |
| 1996        | 877.6              |                    |                    | 1,332.4     | 14.2                        |
| 1997        | 977.9              | 36.2               | 44.8               | 1,331.9     | 17.1                        |
| 1998        | 344.9              | 78.3               | 144.5              | 769.5       | 21.6                        |
| 1999        | 204.0              | 102.2              | 100.7              | 575.1       | 22.6                        |
| 2000        | 772.7              | 124.0              | 153.6              | 1,398.8     | 20.2                        |
| 2001        | 863.1              | 162.8              | 152.4              | 1,401.4     | 22.7                        |
| 2002        | 1,040.0            | 158.5              | 110.1              | 1,565.2     | 21.8                        |
| 2003        | 488.6              | 89.8               | 130.8              | 944.4       | 20.3                        |
| 2004        | 232.5              | 48.1               | 155.5              | 706.3       | 22.8                        |
| 2005        | 411.6              | 47.7               | 73.9               | 669.2       | 13.9                        |
| 2006        | 618.6              | 144.3              | 55.7               | 1,042.1     | 13.6                        |
| 2007        | 1,114.0            | 133.4              | 176.1              | 1,671.1     | 19.2                        |
| 2008        | 1,097.8            | 169.2              | 281.2              | 2,044.8     | 21.0                        |
| 2009        | 167.3              | 499.9              | 442.8              | 1,468.5     | 17.3                        |
| 2010        | 125.6              | 373.3              | 366.1              | 1,302.4     | 23.5                        |
| 2011        | 102.6              | 144.9              | 292.7              | 645.5       | 16.2                        |
| 2012        | 137.0              | 365.8              | 699.1              | 1,486.2     | 36.9                        |
| 2013        | 35.2               | 476.5              | 436.1              | 1,123.3     | 21.9                        |

Table 4.3 – GOA NMFS bottom trawl survey biomass (in mt) and population estimates

| Year | Species | Total biomass | std dev | Total numbers | std dev    |
|------|---------|---------------|---------|---------------|------------|
| 1984 | U       | 137,623       | 12,208  | 404,285,245   | 43,401,215 |
| 1987 | U       | 123,393       | 20,329  | 281,015,223   | 37,864,353 |
| 1990 | U       | 156,032       | 19,472  | 329,427,129   | 40,836,229 |
| 1993 | U       | 173,044       | 14,570  | 346,198,094   | 29,291,722 |
|      |         |               |         |               |            |
| 1996 | N       | 78,845        | 9,930   | 208,492,467   | 30,477,247 |
| 1999 | N       | 61,543        | 15,134  | 151,313,021   | 34,652,753 |
| 2001 | N       | 64,809        | 9,887   | 140,508,433   | 17,513,605 |
| 2003 | N       | 79,648        | 9,514   | 203,049,571   | 26,460,258 |
| 2005 | N       | 91,459        | 10,123  | 216,801,482   | 23,769,367 |
| 2007 | N       | 102,303       | 12,046  | 227,003,343   | 26,624,065 |
| 2009 | N       | 95,846        | 16,068  | 257,075,774   | 51,973,203 |
| 2011 | N       | 72,875        | 12,427  | 148,039,674   | 24,568,593 |
| 2013 | N       | 74,586        | 13,587  | 152,326,011   | 31,004,369 |
|      |         |               |         |               |            |
| 1996 | S       | 127,390       | 12,580  | 186,116,865   | 16,990,673 |
| 1999 | S       | 106,235       | 10,580  | 154,084,268   | 15,292,879 |
| 2001 | S       | 122,492       | 14,643  | 174,732,258   | 20,118,997 |
| 2003 | S       | 126,819       | 12,480  | 199,376,622   | 15,983,336 |
| 2005 | S       | 147,665       | 15,084  | 240,030,524   | 25,605,394 |
| 2007 | S       | 161,617       | 11,764  | 256,910,791   | 19,144,732 |
| 2009 | S       | 191,765       | 22,591  | 300,479,225   | 33,990,620 |
| 2011 | S       | 120,573       | 10,318  | 174,623,722   | 15,912,209 |
| 2013 | S       | 131,441       | 13,993  | 182,199,716   | 16,748,495 |

Table 4.4 – Results for the projection scenarios for northern rock sole for Model 3

| Scenarios 1 and 2, Maximum tier 3 ABC harvest permissible |        |        |       |        |       |           |
|---|--------|--------|-------|--------|-------|-----------|
| Year  | ABC    | OFL    | Catch | SSB    | F     | Total Bio |
| 2012  | 10,061 | 11,740 | 1,414 | 43,810 | 0.020 | 90,832    |
| 2013  | 9,743  | 11,369 | 2,000 | 43,389 | 0.030 | 88,913    |
| 2014  | 9,432  | 11,007 | 9,432 | 40,638 | 0.152 | 87,317    |
| 2015  | 8,382  | 9,784  | 8,382 | 34,460 | 0.152 | 79,324    |
| 2016  | 7,653  | 8,934  | 7,653 | 29,590 | 0.152 | 73,842    |
| 2017  | 7,163  | 8,363  | 7,163 | 26,404 | 0.152 | 70,186    |
| 2018  | 6,843  | 7,990  | 6,843 | 24,363 | 0.152 | 67,738    |
| 2019  | 6,631  | 7,742  | 6,631 | 23,013 | 0.152 | 66,097    |
| 2020  | 6,456  | 7,536  | 6,456 | 22,139 | 0.151 | 65,001    |
| 2021  | 6,317  | 7,371  | 6,317 | 21,608 | 0.150 | 64,268    |
| 2022  | 6,214  | 7,250  | 6,214 | 21,262 | 0.148 | 63,818    |
| 2023  | 6,155  | 7,180  | 6,155 | 21,018 | 0.148 | 63,567    |
| 2024  | 6,120  | 7,140  | 6,120 | 20,884 | 0.147 | 63,488    |
| 2025  | 6,105  | 7,121  | 6,105 | 20,806 | 0.147 | 63,464    |
| 2026  | 6,101  | 7,117  | 6,101 | 20,746 | 0.147 | 63,389    |
|   |        |        |       |        |       |           |
| Scenario 3, $F_{ABC}$ at average F over the past 5 years  |        |        |       |        |       |           |
| Year  | ABC    | OFL    | Catch | SSB    | F     | Total Bio |
| 2012  | 2,549  | 11,740 | 1,414 | 43,810 | 0.020 | 90,832    |
| 2013  | 2,469  | 11,369 | 2,000 | 43,389 | 0.030 | 88,913    |
| 2014  | 2,389  | 11,007 | 2,389 | 41,384 | 0.037 | 87,317    |
| 2015  | 2,331  | 10,746 | 2,331 | 39,040 | 0.037 | 86,262    |
| 2016  | 2,306  | 10,637 | 2,306 | 37,104 | 0.037 | 86,051    |
| 2017  | 2,305  | 10,634 | 2,305 | 36,256 | 0.037 | 86,401    |
| 2018  | 2,319  | 10,699 | 2,319 | 36,119 | 0.037 | 87,010    |
| 2019  | 2,339  | 10,793 | 2,339 | 36,296 | 0.037 | 87,716    |
| 2020  | 2,360  | 10,890 | 2,360 | 36,625 | 0.037 | 88,426    |
| 2021  | 2,380  | 10,982 | 2,380 | 37,038 | 0.037 | 89,051    |
| 2022  | 2,397  | 11,062 | 2,397 | 37,411 | 0.037 | 89,595    |
| 2023  | 2,412  | 11,128 | 2,412 | 37,695 | 0.037 | 90,057    |
| 2024  | 2,424  | 11,184 | 2,424 | 37,958 | 0.037 | 90,493    |
| 2025  | 2,435  | 11,234 | 2,435 | 38,177 | 0.037 | 90,843    |
| 2026  | 2,444  | 11,278 | 2,444 | 38,334 | 0.037 | 91,048    |
|   |        |        |       |        |       |           |
| Scenario 4, 1/2 Maximum ABC harvest permissible           |        |        |       |        |       |           |
| Year  | ABC    | OFL    | Catch | SSB    | F     | Total Bio |
| 2012  | 5,270  | 11,740 | 1,414 | 43,810 | 0.020 | 90,832    |
| 2013  | 5,104  | 11,369 | 2,000 | 43,389 | 0.030 | 88,913    |
| 2014  | 4,940  | 11,007 | 4,940 | 41,120 | 0.077 | 87,317    |
| 2015  | 4,664  | 10,397 | 4,664 | 37,367 | 0.077 | 83,748    |
| 2016  | 4,484  | 10,000 | 4,484 | 34,269 | 0.077 | 81,494    |

|      |       |       |       |        |       |        |
|------|-------|-------|-------|--------|-------|--------|
| 2017 | 4,375 | 9,762 | 4,375 | 32,426 | 0.077 | 80,184 |
| 2018 | 4,316 | 9,632 | 4,316 | 31,427 | 0.077 | 79,440 |
| 2019 | 4,287 | 9,567 | 4,287 | 30,871 | 0.077 | 79,045 |
| 2020 | 4,271 | 9,533 | 4,271 | 30,587 | 0.077 | 78,856 |
| 2021 | 4,264 | 9,518 | 4,264 | 30,487 | 0.077 | 78,752 |
| 2022 | 4,261 | 9,512 | 4,261 | 30,435 | 0.077 | 78,707 |
| 2023 | 4,260 | 9,508 | 4,260 | 30,377 | 0.077 | 78,696 |
| 2024 | 4,260 | 9,508 | 4,260 | 30,360 | 0.077 | 78,753 |
| 2025 | 4,262 | 9,514 | 4,262 | 30,352 | 0.077 | 78,802 |
| 2026 | 4,266 | 9,522 | 4,266 | 30,328 | 0.077 | 78,766 |
|      |       |       |       |        |       |        |

**Scenario 5, No fishing ( $F_{ABC} = 0$ )**

| Year | ABC | OFL    | Catch | SSB    | F     | Total Bio |
|------|-----|--------|-------|--------|-------|-----------|
| 2012 | 0   | 11,740 | 1,414 | 43,810 | 0.020 | 90,832    |
| 2013 | 0   | 11,369 | 2,000 | 43,389 | 0.030 | 88,913    |
| 2014 | 0   | 11,007 | 0     | 41,624 | 0.000 | 87,317    |
| 2015 | 0   | 11,073 | 0     | 40,621 | 0.000 | 88,618    |
| 2016 | 0   | 11,253 | 0     | 39,879 | 0.000 | 90,460    |
| 2017 | 0   | 11,506 | 0     | 40,128 | 0.000 | 92,599    |
| 2018 | 0   | 11,795 | 0     | 41,008 | 0.000 | 94,765    |
| 2019 | 0   | 12,086 | 0     | 42,106 | 0.000 | 96,827    |
| 2020 | 0   | 12,354 | 0     | 43,255 | 0.000 | 98,713    |
| 2021 | 0   | 12,594 | 0     | 44,393 | 0.000 | 100,350   |
| 2022 | 0   | 12,802 | 0     | 45,399 | 0.000 | 101,760   |
| 2023 | 0   | 12,976 | 0     | 46,229 | 0.000 | 102,959   |
| 2024 | 0   | 13,124 | 0     | 46,961 | 0.000 | 104,018   |
| 2025 | 0   | 13,252 | 0     | 47,582 | 0.000 | 104,892   |
| 2026 | 0   | 13,361 | 0     | 48,078 | 0.000 | 105,538   |
|      |     |        |       |        |       |           |

**Scenario 6, Whether N rock sole are overfished –  $SB_{35\%} = 17,400$**

| Year | ABC    | OFL    | Catch  | SSB    | F     | Total Bio |
|------|--------|--------|--------|--------|-------|-----------|
| 2012 | 11,740 | 11,740 | 1,414  | 43,810 | 0.020 | 90,832    |
| 2013 | 11,369 | 11,369 | 11,369 | 42,381 | 0.180 | 88,913    |
| 2014 | 9,725  | 9,725  | 9,725  | 35,252 | 0.180 | 78,123    |
| 2015 | 8,584  | 8,584  | 8,584  | 29,306 | 0.180 | 70,827    |
| 2016 | 7,838  | 7,838  | 7,838  | 24,806 | 0.180 | 66,134    |
| 2017 | 7,372  | 7,372  | 7,372  | 22,022 | 0.180 | 63,226    |
| 2018 | 6,987  | 6,987  | 6,987  | 20,379 | 0.177 | 61,419    |
| 2019 | 6,598  | 6,598  | 6,598  | 19,441 | 0.170 | 60,401    |
| 2020 | 6,414  | 6,414  | 6,414  | 19,003 | 0.166 | 60,026    |
| 2021 | 6,355  | 6,355  | 6,355  | 18,858 | 0.165 | 59,944    |
| 2022 | 6,340  | 6,340  | 6,340  | 18,819 | 0.164 | 59,986    |
| 2023 | 6,347  | 6,347  | 6,347  | 18,804 | 0.164 | 60,073    |
| 2024 | 6,365  | 6,365  | 6,365  | 18,835 | 0.164 | 60,216    |

|      |       |       |       |        |       |        |
|------|-------|-------|-------|--------|-------|--------|
| 2025 | 6,377 | 6,377 | 6,377 | 18,863 | 0.164 | 60,324 |
| 2026 | 6,394 | 6,394 | 6,394 | 18,873 | 0.164 | 60,328 |
|      |       |       |       |        |       |        |

**Scenario 7, Whether N rock sole is approaching overfished condition**

| Year | ABC    | OFL    | Catch | SSB    | F     | Total Bio |
|------|--------|--------|-------|--------|-------|-----------|
| 2012 | 11,740 | 11,740 | 1,414 | 43,810 | 0.020 | 90,832    |
| 2013 | 11,369 | 11,369 | 9,743 | 42,564 | 0.152 | 88,913    |
| 2014 | 9,947  | 9,947  | 8,523 | 36,309 | 0.152 | 79,717    |
| 2015 | 8,949  | 8,949  | 8,949 | 30,792 | 0.180 | 73,439    |
| 2016 | 8,118  | 8,118  | 8,118 | 25,985 | 0.180 | 68,101    |
| 2017 | 7,581  | 7,581  | 7,581 | 22,945 | 0.180 | 64,677    |
| 2018 | 7,216  | 7,216  | 7,216 | 21,077 | 0.179 | 62,470    |
| 2019 | 6,790  | 6,790  | 6,790 | 19,921 | 0.172 | 61,072    |
| 2020 | 6,536  | 6,536  | 6,536 | 19,303 | 0.168 | 60,397    |
| 2021 | 6,420  | 6,420  | 6,420 | 19,031 | 0.166 | 60,120    |
| 2022 | 6,371  | 6,371  | 6,371 | 18,909 | 0.165 | 60,053    |
| 2023 | 6,358  | 6,358  | 6,358 | 18,845 | 0.164 | 60,085    |
| 2024 | 6,367  | 6,367  | 6,367 | 18,848 | 0.164 | 60,205    |
| 2025 | 6,375  | 6,375  | 6,375 | 18,864 | 0.164 | 60,305    |
| 2026 | 6,391  | 6,391  | 6,391 | 18,869 | 0.164 | 60,310    |



Table 4.5 – Results of the projection scenarios for southern rock sole for Model 3

| Scenarios 1 and 2, Maximum tier 3 ABC harvest permissible |        |        |        |        |       |           |
|---|--------|--------|--------|--------|-------|-----------|
| Year  | ABC    | OFL    | Catch  | SSB    | F     | Total Bio |
| 2012  | 18,770 | 22,100 | 1,414  | 85,758 | 0.014 | 209,978   |
| 2013  | 18,589 | 21,882 | 2,000  | 87,561 | 0.020 | 208,511   |
| 2014  | 18,259 | 21,490 | 18,259 | 81,571 | 0.193 | 208,843   |
| 2015  | 16,095 | 18,946 | 16,095 | 69,397 | 0.193 | 195,257   |
| 2016  | 14,458 | 17,025 | 14,458 | 58,548 | 0.193 | 187,356   |
| 2017  | 13,328 | 15,700 | 13,328 | 50,267 | 0.193 | 183,472   |
| 2018  | 12,498 | 14,607 | 12,498 | 44,930 | 0.191 | 182,173   |
| 2019  | 11,519 | 13,464 | 11,519 | 42,444 | 0.180 | 182,674   |
| 2020  | 11,283 | 13,209 | 11,283 | 41,971 | 0.177 | 184,572   |
| 2021  | 11,388 | 13,347 | 11,388 | 42,445 | 0.177 | 186,685   |
| 2022  | 11,629 | 13,641 | 11,629 | 43,314 | 0.179 | 188,622   |
| 2023  | 11,865 | 13,928 | 11,865 | 44,216 | 0.180 | 190,121   |
| 2024  | 12,066 | 14,170 | 12,066 | 45,000 | 0.182 | 191,428   |
| 2025  | 12,230 | 14,366 | 12,230 | 45,609 | 0.183 | 192,201   |
| 2026  | 12,343 | 14,502 | 12,343 | 46,042 | 0.184 | 192,497   |
|   |        |        |        |        |       |           |
| Scenario 3, $F_{ABC}$ at average F over the past 5 years  |        |        |        |        |       |           |
| Year  | ABC    | OFL    | Catch  | SSB    | F     | Total Bio |
| 2012  | 3,697  | 22,100 | 1,414  | 85,758 | 0.014 | 209,978   |
| 2013  | 3,665  | 21,882 | 2,000  | 87,561 | 0.020 | 208,511   |
| 2014  | 3,603  | 21,490 | 3,603  | 86,026 | 0.036 | 208,843   |
| 2015  | 3,507  | 20,916 | 3,507  | 81,869 | 0.036 | 209,774   |
| 2016  | 3,436  | 20,507 | 3,436  | 76,928 | 0.036 | 212,775   |
| 2017  | 3,401  | 20,317 | 3,401  | 72,823 | 0.036 | 217,052   |
| 2018  | 3,402  | 20,348 | 3,402  | 70,431 | 0.036 | 221,945   |
| 2019  | 3,435  | 20,569 | 3,435  | 70,086 | 0.036 | 227,152   |
| 2020  | 3,492  | 20,928 | 3,492  | 71,335 | 0.036 | 232,230   |
| 2021  | 3,564  | 21,370 | 3,564  | 73,383 | 0.036 | 236,869   |
| 2022  | 3,642  | 21,846 | 3,642  | 75,792 | 0.036 | 241,064   |
| 2023  | 3,721  | 22,318 | 3,721  | 78,182 | 0.036 | 244,710   |
| 2024  | 3,796  | 22,765 | 3,796  | 80,397 | 0.036 | 248,050   |
| 2025  | 3,864  | 23,168 | 3,864  | 82,349 | 0.036 | 250,719   |
| 2026  | 3,924  | 23,521 | 3,924  | 84,014 | 0.036 | 252,752   |
|   |        |        |        |        |       |           |
| Scenario 4, 1/2 Maximum ABC harvest permissible           |        |        |        |        |       |           |
| Year  | ABC    | OFL    | Catch  | SSB    | F     | Total Bio |
| 2012  | 9,543  | 22,100 | 1,414  | 85,758 | 0.014 | 209,978   |
| 2013  | 9,458  | 21,882 | 2,000  | 87,561 | 0.020 | 208,511   |
| 2014  | 9,294  | 21,490 | 9,294  | 84,321 | 0.095 | 208,843   |
| 2015  | 8,712  | 20,148 | 8,712  | 76,922 | 0.095 | 204,135   |
| 2016  | 8,255  | 19,104 | 8,255  | 69,384 | 0.095 | 202,601   |

|      |       |        |       |        |       |         |
|------|-------|--------|-------|--------|-------|---------|
| 2017 | 7,942 | 18,399 | 7,942 | 63,261 | 0.095 | 203,241 |
| 2018 | 7,767 | 18,014 | 7,767 | 59,286 | 0.095 | 205,190 |
| 2019 | 7,707 | 17,894 | 7,707 | 57,609 | 0.095 | 207,970 |
| 2020 | 7,732 | 17,966 | 7,732 | 57,650 | 0.095 | 210,995 |
| 2021 | 7,810 | 18,157 | 7,810 | 58,586 | 0.095 | 213,856 |
| 2022 | 7,916 | 18,404 | 7,916 | 59,950 | 0.095 | 216,484 |
| 2023 | 8,031 | 18,666 | 8,031 | 61,376 | 0.095 | 218,735 |
| 2024 | 8,142 | 18,923 | 8,142 | 62,700 | 0.095 | 220,830 |
| 2025 | 8,243 | 19,157 | 8,243 | 63,840 | 0.095 | 222,390 |
| 2026 | 8,328 | 19,354 | 8,328 | 64,775 | 0.095 | 223,441 |
|      |       |        |       |        |       |         |

**Scenario 5, No fishing ( $F_{ABC} = 0$ )**

| Year | ABC | OFL    | Catch | SSB     | F     | Total Bio |
|------|-----|--------|-------|---------|-------|-----------|
| 2012 | 0   | 22,100 | 1,414 | 85,758  | 0.014 | 209,978   |
| 2013 | 0   | 21,882 | 2,000 | 87,561  | 0.020 | 208,511   |
| 2014 | 0   | 21,490 | 0     | 87,089  | 0.000 | 208,843   |
| 2015 | 0   | 21,403 | 0     | 85,067  | 0.000 | 213,345   |
| 2016 | 0   | 21,428 | 0     | 81,981  | 0.000 | 219,418   |
| 2017 | 0   | 21,618 | 0     | 79,452  | 0.000 | 226,335   |
| 2018 | 0   | 21,981 | 0     | 78,411  | 0.000 | 233,510   |
| 2019 | 0   | 22,495 | 0     | 79,285  | 0.000 | 240,719   |
| 2020 | 0   | 23,115 | 0     | 81,683  | 0.000 | 247,576   |
| 2021 | 0   | 23,794 | 0     | 84,821  | 0.000 | 253,819   |
| 2022 | 0   | 24,490 | 0     | 88,269  | 0.000 | 259,475   |
| 2023 | 0   | 25,168 | 0     | 91,636  | 0.000 | 264,457   |
| 2024 | 0   | 25,806 | 0     | 94,767  | 0.000 | 269,022   |
| 2025 | 0   | 26,389 | 0     | 97,572  | 0.000 | 272,808   |
| 2026 | 0   | 26,909 | 0     | 100,021 | 0.000 | 275,856   |
|      |     |        |       |         |       |           |

**Scenario 6, Whether S rock sole are overfished –  $SB_{35\%} = 39,000$**

| Year | ABC    | OFL    | Catch  | SSB    | F     | Total Bio |
|------|--------|--------|--------|--------|-------|-----------|
| 2012 | 22,100 | 22,100 | 1,414  | 85,758 | 0.014 | 209,978   |
| 2013 | 21,882 | 21,882 | 21,882 | 81,656 | 0.230 | 208,511   |
| 2014 | 18,835 | 18,835 | 18,835 | 69,720 | 0.230 | 189,152   |
| 2015 | 16,445 | 16,445 | 16,445 | 58,263 | 0.230 | 177,166   |
| 2016 | 14,724 | 14,724 | 14,724 | 48,426 | 0.230 | 170,977   |
| 2017 | 12,518 | 12,518 | 12,518 | 41,499 | 0.210 | 168,717   |
| 2018 | 11,016 | 11,016 | 11,016 | 37,829 | 0.191 | 169,944   |
| 2019 | 10,719 | 10,719 | 10,719 | 36,803 | 0.185 | 173,396   |
| 2020 | 11,061 | 11,061 | 11,061 | 37,332 | 0.188 | 177,249   |
| 2021 | 11,612 | 11,612 | 11,612 | 38,464 | 0.193 | 180,502   |
| 2022 | 12,162 | 12,162 | 12,162 | 39,717 | 0.199 | 182,963   |
| 2023 | 12,612 | 12,612 | 12,612 | 40,793 | 0.203 | 184,573   |
| 2024 | 12,920 | 12,920 | 12,920 | 41,597 | 0.206 | 185,721   |

|  |            |            |              |            |          |                  |
|--|------------|------------|--------------|------------|----------|------------------|
| 2025   | 13,115     | 13,115     | 13,115       | 42,135     | 0.208    | 186,213          |
| 2026   | 13,229     | 13,229     | 13,229       | 42,454     | 0.209    | 186,207          |
|  |            |            |              |            |          |                  |
| <b>Scenario 7, Whether S rock sole is approaching overfished condition</b> |            |            |              |            |          |                  |
| <b>Year</b>  | <b>ABC</b> | <b>OFL</b> | <b>Catch</b> | <b>SSB</b> | <b>F</b> | <b>Total Bio</b> |
| 2012   | 22,100     | 22,100     | 1,414        | 85,758     | 0.014    | 209,978          |
| 2013   | 21,882     | 21,882     | 18,589       | 82,661     | 0.193    | 208,511          |
| 2014   | 19,273     | 19,273     | 16,372       | 72,394     | 0.193    | 192,411          |
| 2015   | 17,170     | 17,170     | 17,170       | 61,222     | 0.230    | 182,517          |
| 2016   | 15,286     | 15,286     | 15,286       | 50,712     | 0.230    | 175,020          |
| 2017   | 13,418     | 13,418     | 13,418       | 43,129     | 0.219    | 171,734          |
| 2018   | 11,559     | 11,559     | 11,559       | 38,887     | 0.196    | 171,686          |
| 2019   | 11,058     | 11,058     | 11,058       | 37,487     | 0.189    | 174,345          |
| 2020   | 11,263     | 11,263     | 11,263       | 37,752     | 0.190    | 177,696          |
| 2021   | 11,720     | 11,720     | 11,720       | 38,699     | 0.194    | 180,646          |
| 2022   | 12,209     | 12,209     | 12,209       | 39,825     | 0.199    | 182,945          |
| 2023   | 12,624     | 12,624     | 12,624       | 40,823     | 0.203    | 184,482          |
| 2024   | 12,914     | 12,914     | 12,914       | 41,584     | 0.206    | 185,611          |
| 2025   | 13,102     | 13,102     | 13,102       | 42,104     | 0.208    | 186,112          |
| 2026   | 13,214     | 13,214     | 13,214       | 42,419     | 0.209    | 186,125          |

Figure 4.1 – Total catch for GOA shallow-water flatfish by area (as of 2013-10-30)

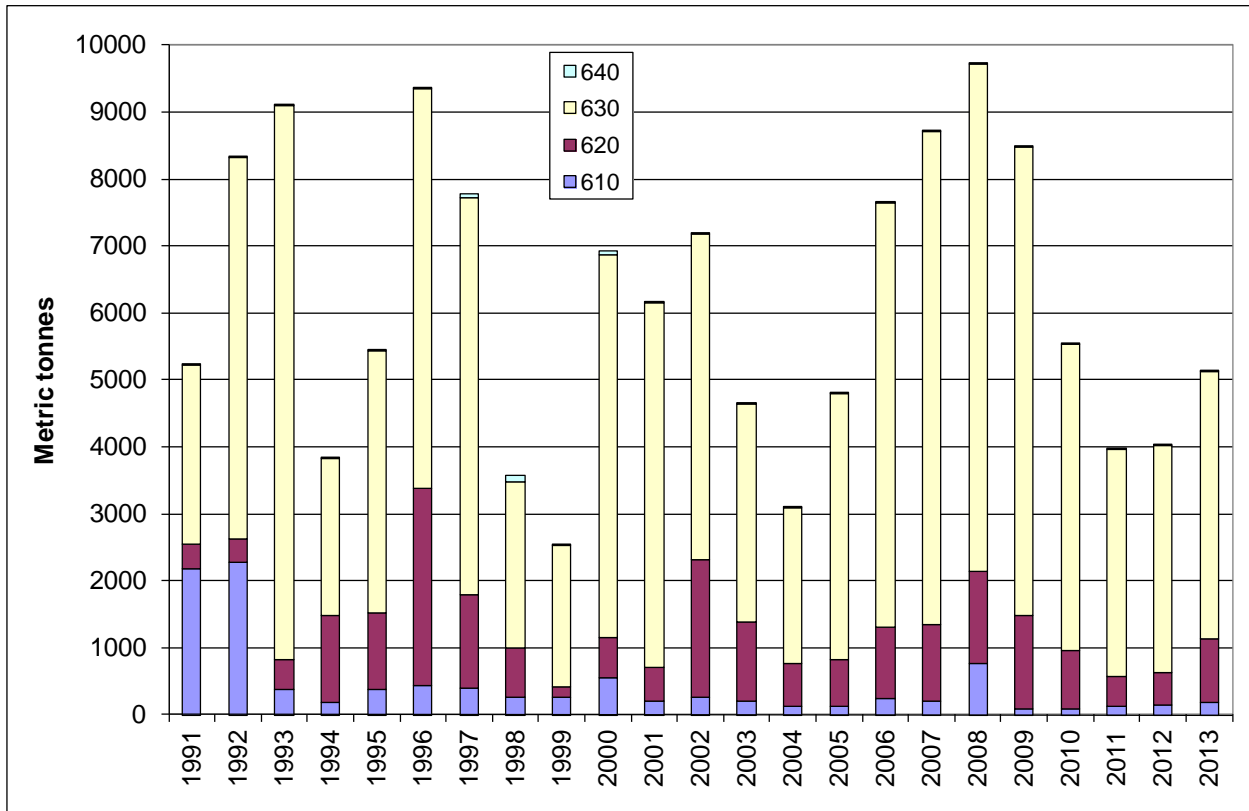


Figure 4.2 – Observed fishery catch of GOA U/N/S rock sole by area (based on extrapolated fishery observer data; as of 2013-10-30)

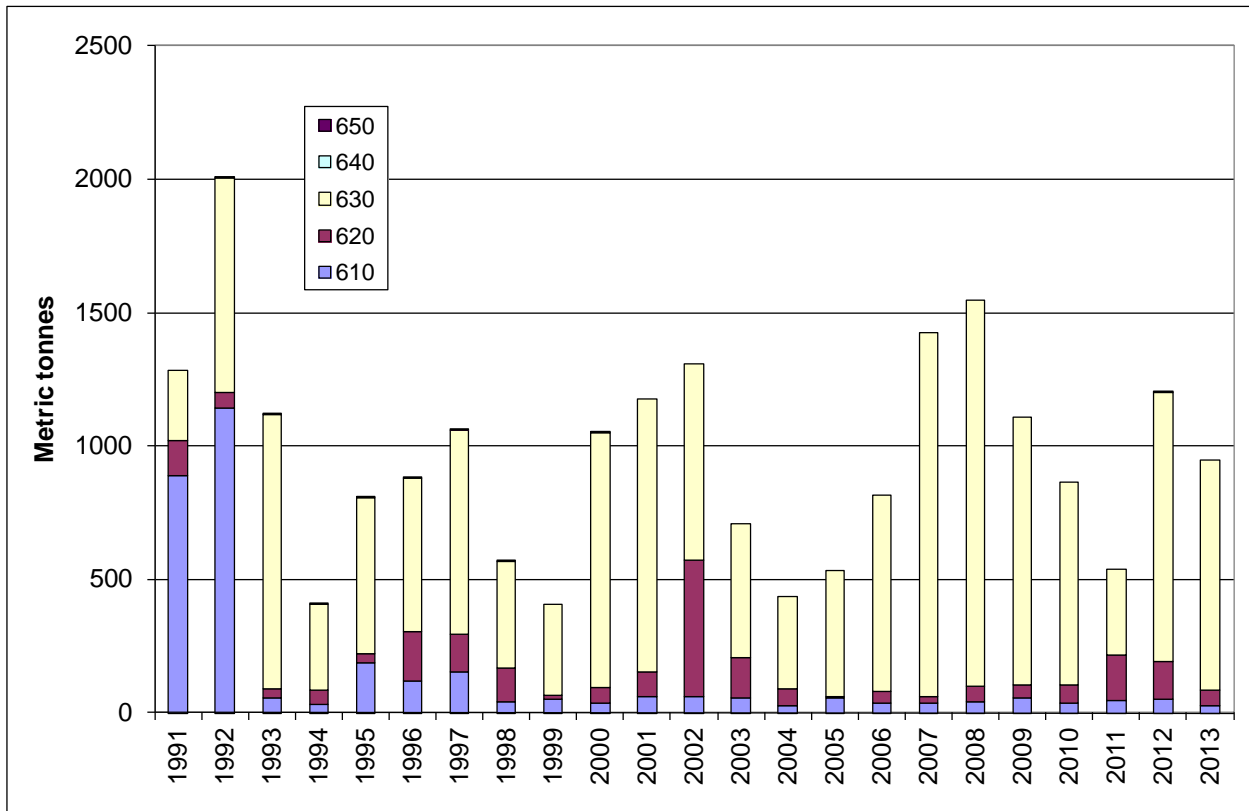


Figure 4.3 – Percent of the total shallow-water flatfish catch that is observed (based on extrapolated fishery observer data; as of 2013-10-30)

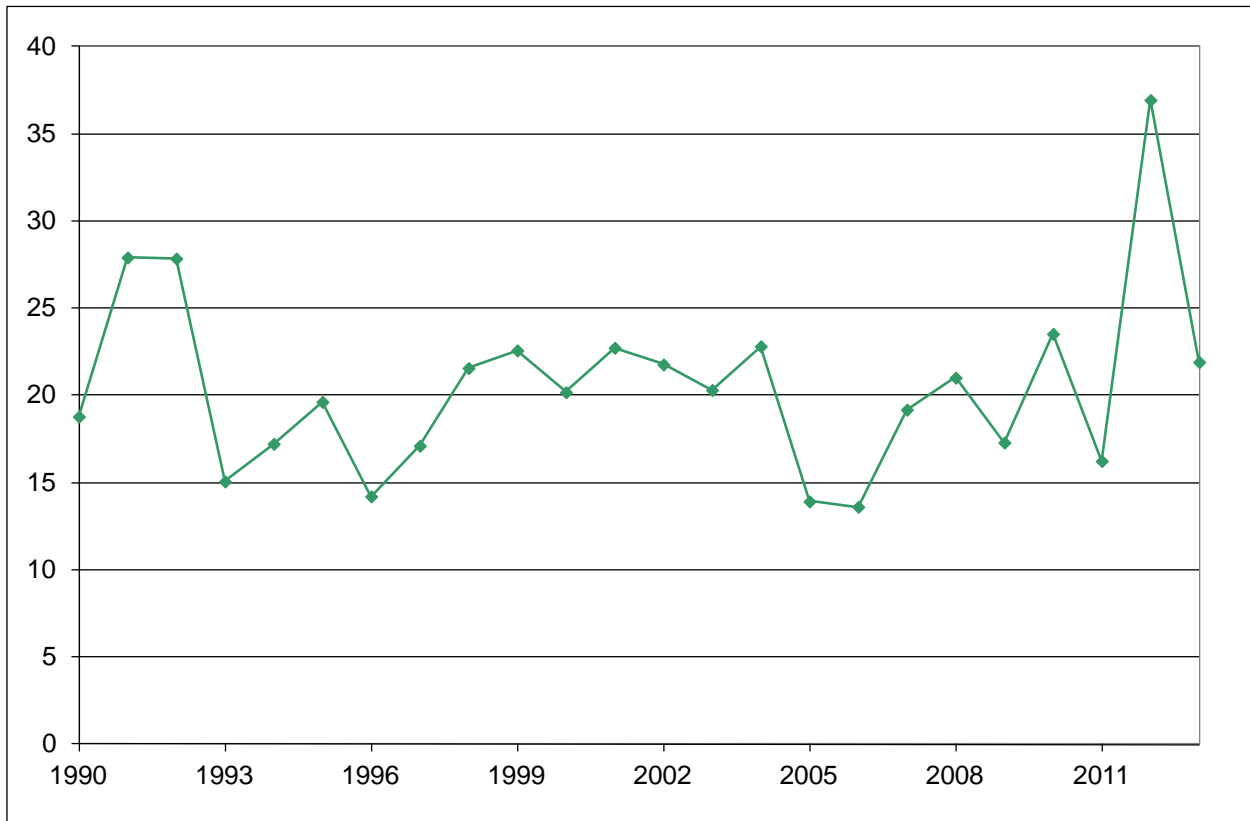


Figure 4.4 – Percent of the observed shallow-water flatfish catch that is U/N/S rock sole (based on extrapolated fishery observer data; as of 2013-10-30)

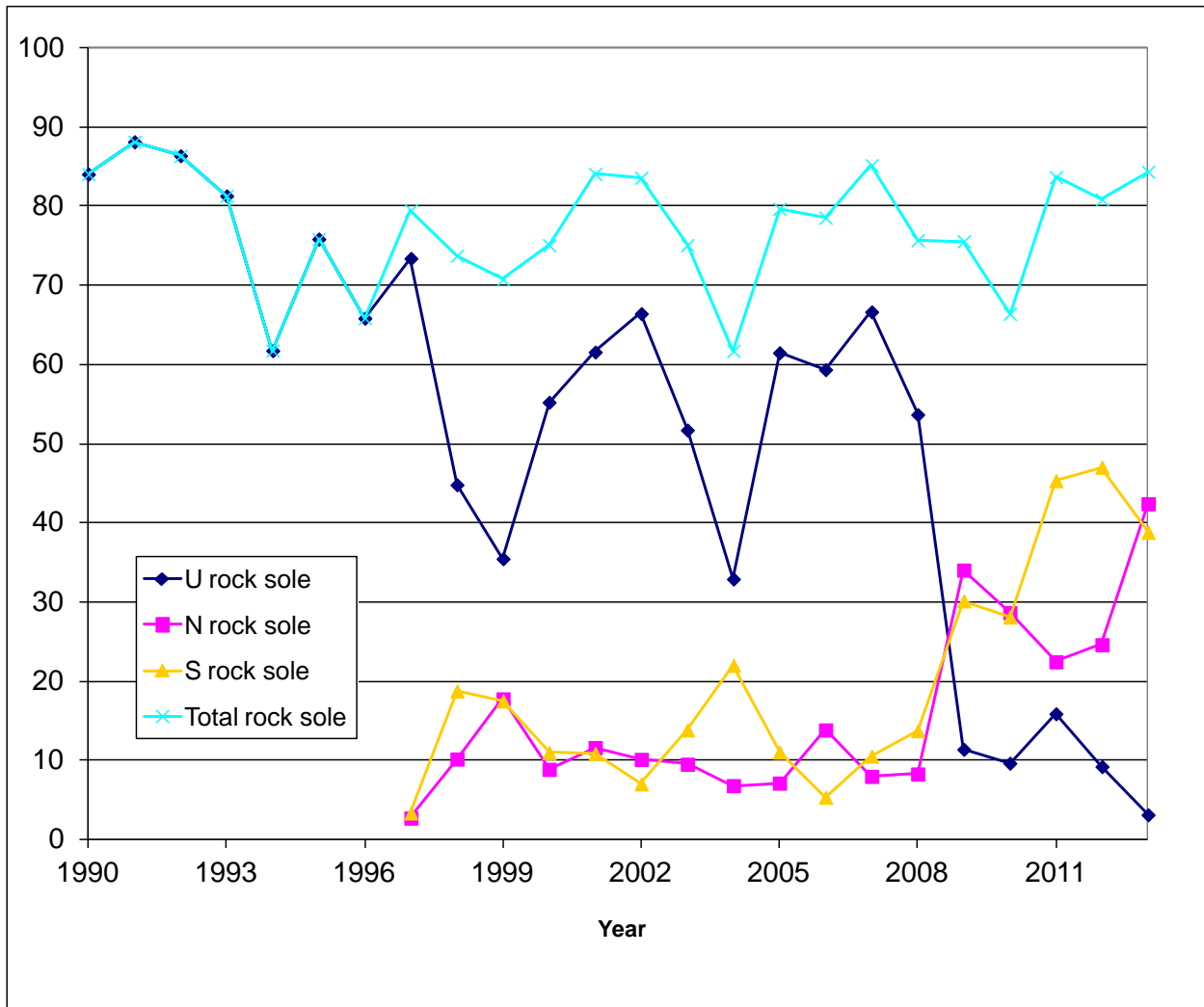


Figure 4.5 – GOA NMFS bottom trawl survey estimates for U rock sole by area

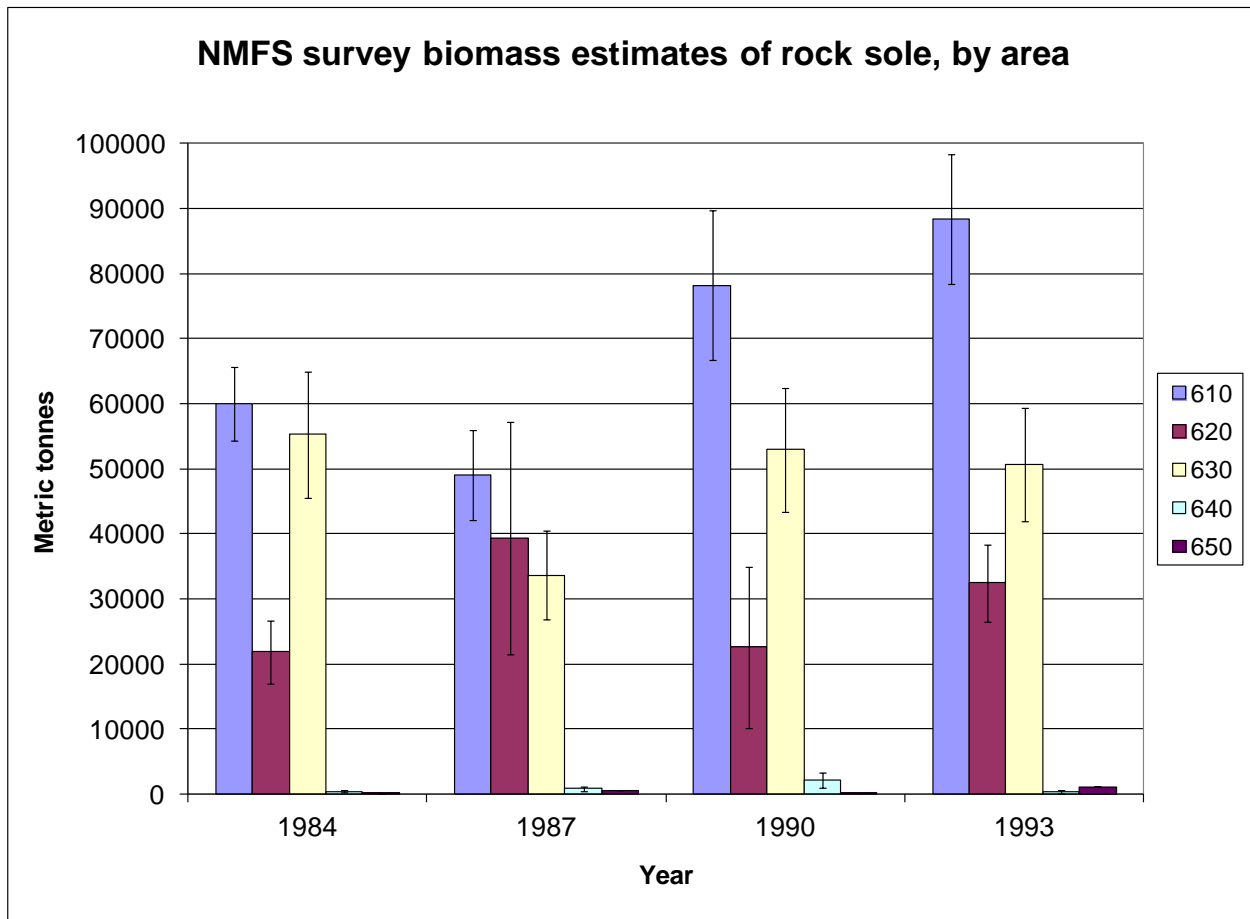




Figure 4.6 – GOA NMFS bottom trawl survey estimates for N rock sole by area

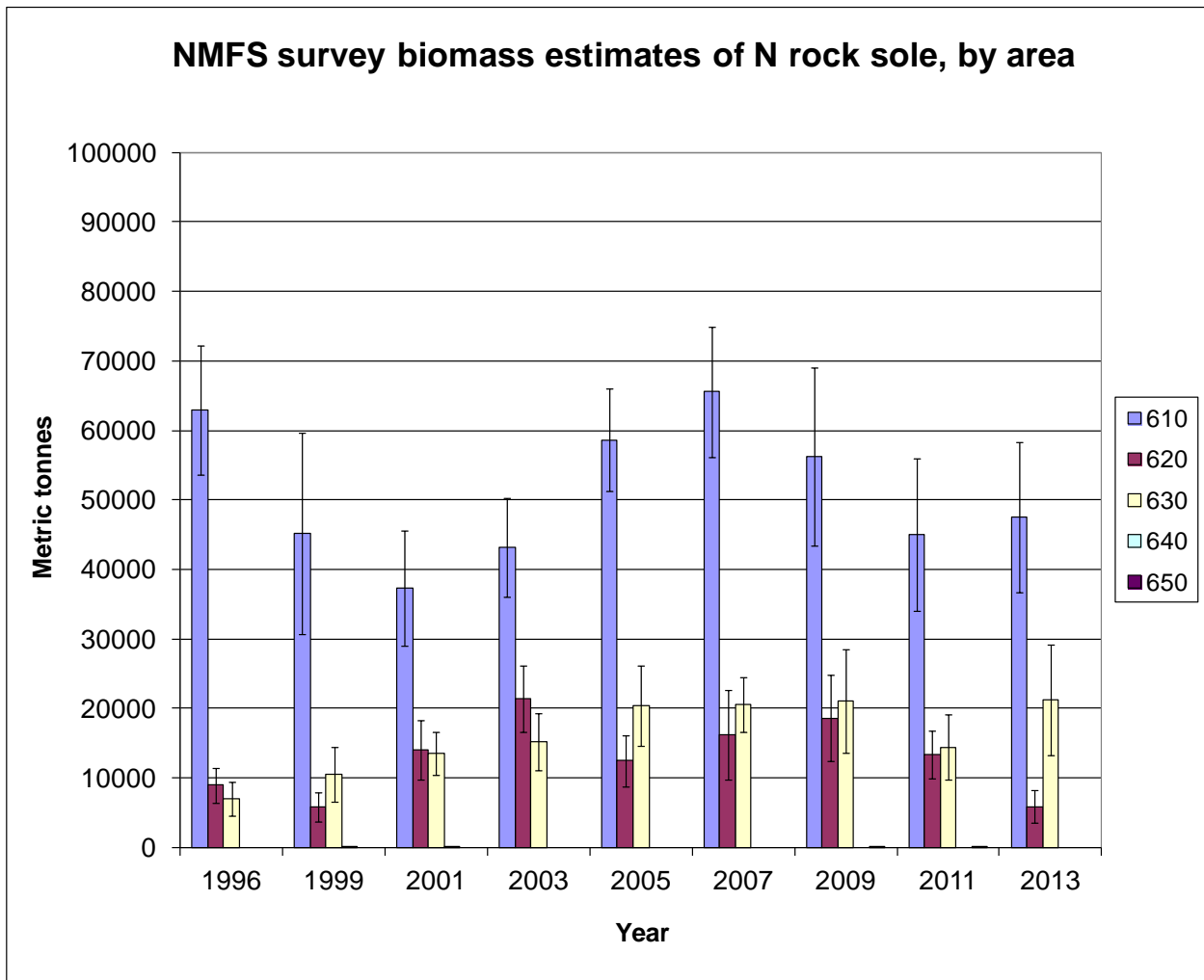


Figure 4.7 – GOA NMFS bottom trawl survey estimates for S rock sole by area

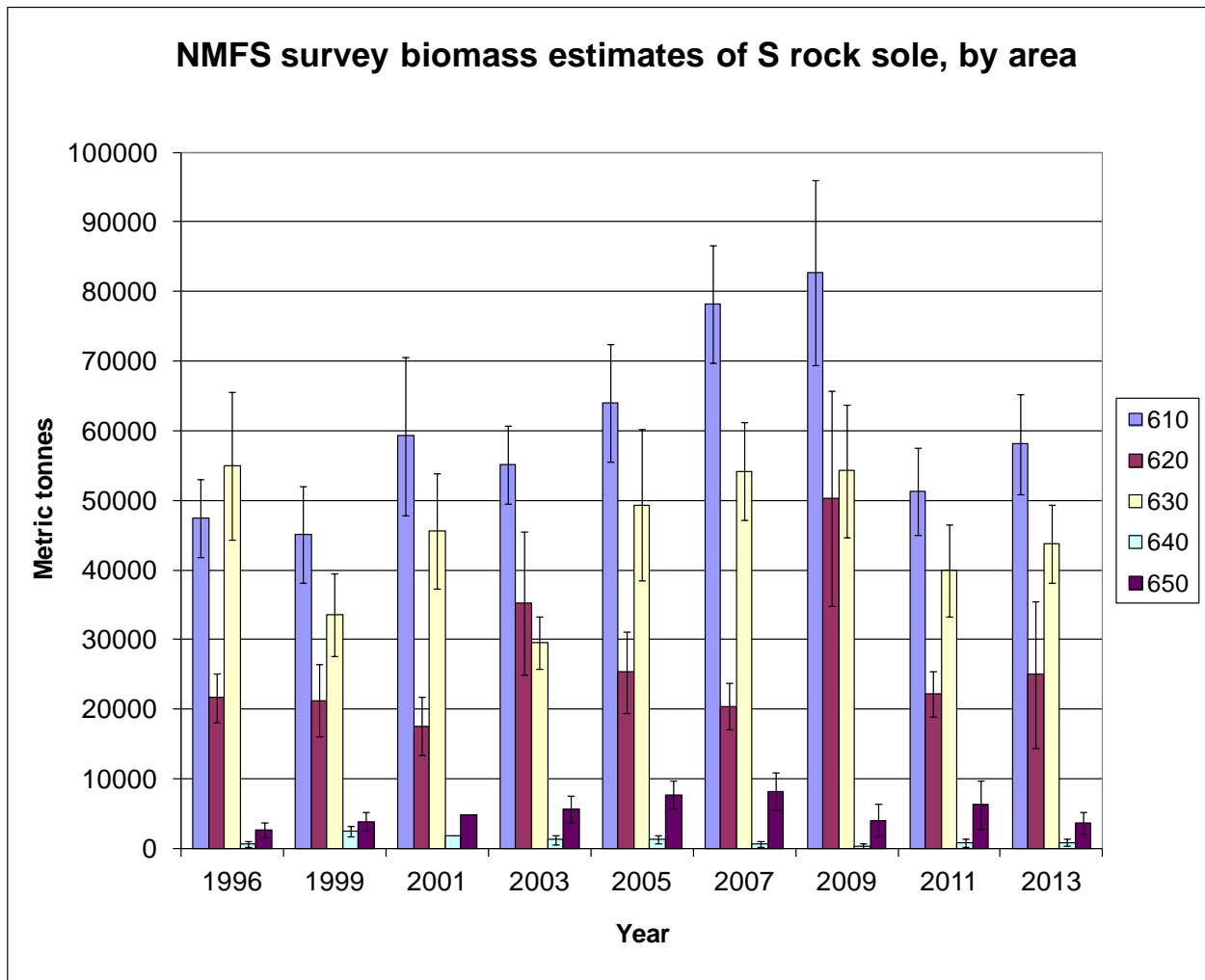


Figure 4.8 – GOA NMFS bottom trawl survey estimates for U/N/S rock sole

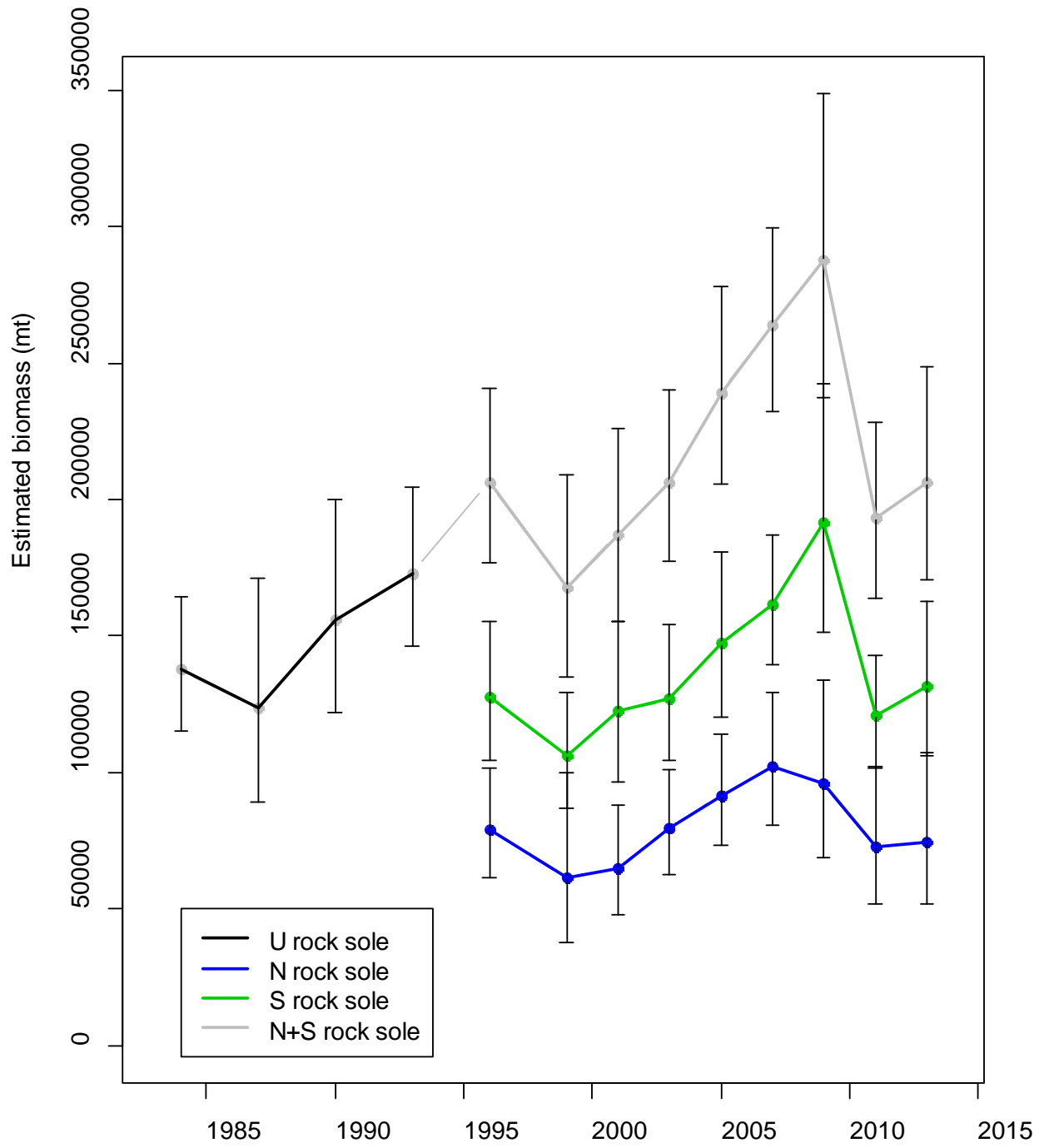


Figure 4.9 – Population lengths from the GOA NMFS bottom trawl survey for northern rock sole (female – top half of each plot, male – bottom half of each plot; the x-axis is 1 to 66 cm)

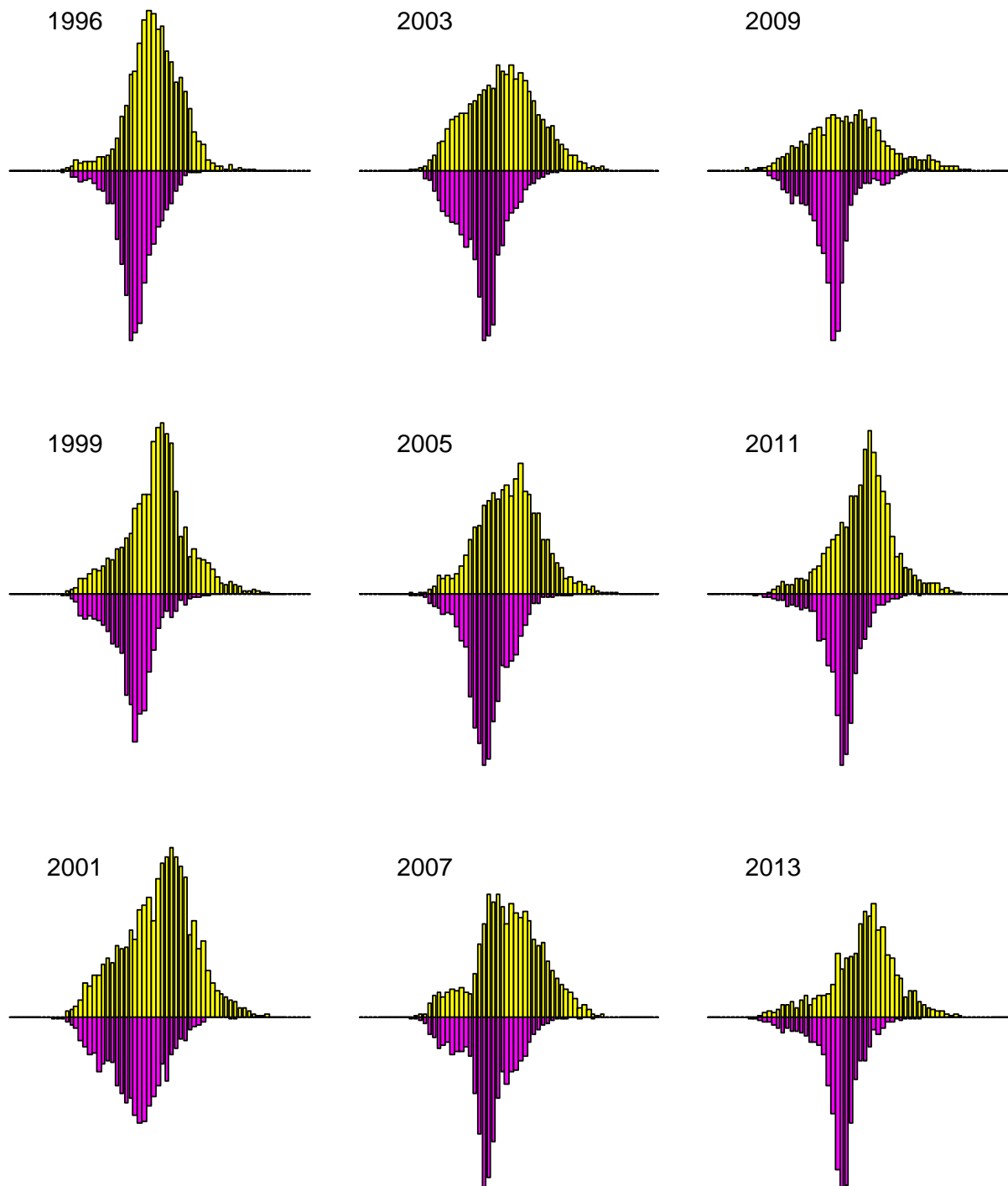
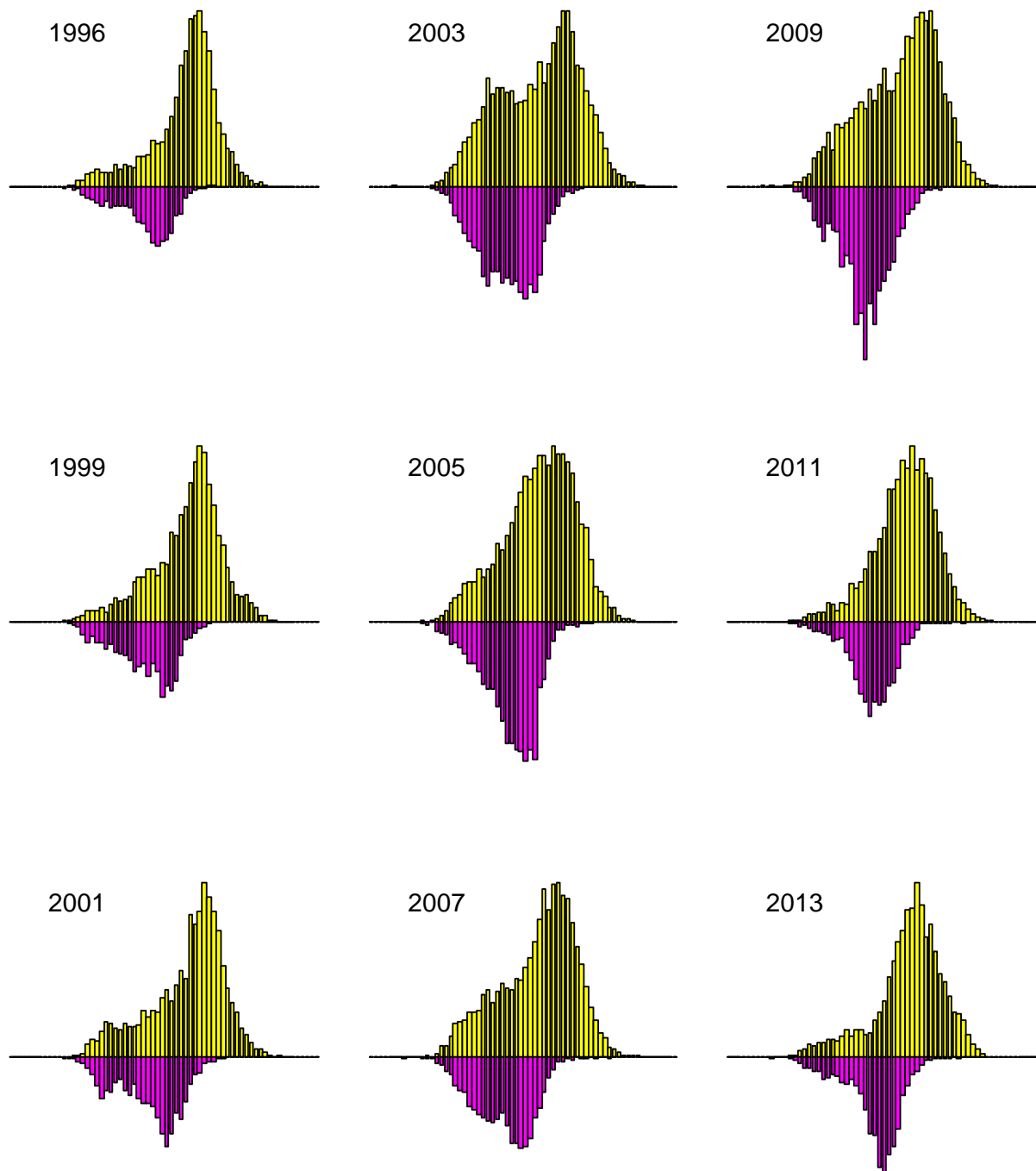


Figure 4.10 – Population lengths from the GOA NMFS bottom trawl survey for southern rock sole (female – top half of each plot, male – bottom half of each plot; the x-axis is 1 to 66 cm)



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