Table S1 Pearson’s correlation coefficient between alternate calculations of percent change in species richness using the minimum ($z = 0.175$), mean ($z = 0.38$), and max ($z = 0.62$) reported exponent values for 2° latitudinal shifts (Levin et al. 2009).

| Percent Change Species Richness $z = 0.175$ | Percent Change Species Richness $z = 0.38$ | Percent Change Species Richness $z = 0.62$ |
|--------------------------------------------|--------------------------------------------|--------------------------------------------|
| Percent Change Species Richness $z = 0.175$ | 1                                          | 0.97                                       | 0.91                                       |
| Percent Change Species Richness $z = 0.38$  | 0.97                                       | 1                                          | 0.99                                       |
| Percent Change Species Richness $z = 0.62$  | 1                                          | 1                                          | 1                                          |
Table S2. Pearson’s correlation coefficient between alternate calculations of percent change in species richness using the minimum ($z = 0.175$), mean ($z = 0.38$), and max ($z = 0.62$) reported exponent values for 15 m depth shifts (Levin et al. 2009).

| percent change in species richness | $z = 0.175$ | $z = 0.38$ | $z = 0.62$ |
|-----------------------------------|------------|------------|------------|
| percent change in species richness | 1          | 0.99       | 0.97       |
| percent change in species richness | 0.99       | 1          | 0.99       |
| percent change in species richness | 0.97       | 0.99       | 1          |
We conducted a comparison to confirm that calculating continental shelf area from unprojected rasters instead of projected shapefiles would not change conclusions of the latitudinal and depth analyses. We tested the difference in area calculations for regions that were likely to present the largest differences due to high latitudes—East Atlantic Ocean for latitudinal shifts and High Arctic Canada/Greenland (LME 66) for depth shifts.

Figure S1. Latitude versus continental shelf area calculated by applying raster::area() function to a projected shapefile for the 2° latitudinal bin using the equal area projection (red) and to an unprojected raster for the 2° latitudinal bin (green). The two alternative methods lead to a Pearson correlation coefficient of 0.99 between the two sets of values.
Figure S2. The distribution of differences between calculated area of 2° latitudinal bins using the unprojected raster and the projected shapefile. The differences range from 0 to 2558 km$^2$, with a mean of 405 km$^2$ and a median of 30 km$^2$. The measured differences scale with the size of the 2° latitudinal bin. At its maximum, the measured difference between the two methodologies is 1% of the total area of the 2° latitudinal bin calculated using the unprojected raster method.
Figure S3. Hypsometric curves for continental shelf area by depth using area calculated from the unprojected raster (left) and from the projected polygon (right). For both methodologies, LME 66 is classified as Mid-Dominant.
Figure S4. Figure 2 in main text but with less conservative skew classification (-0.5/0.5 cutoff). World map with 64 LMEs colored by depth distribution classification. No LMEs were classified as Deep Dominant or Uniform. Three LMEs (5%) reclassified from Mid-Dominant to Shallow-Dominant.
Figure S5. Depth maps for all 64 LMEs included in the analysis. Color represents depth ranging from orange (shallow) to purple (deep).
Figure S6. Hypsometric (area versus depth) curves for all 64 LMEs included in the analysis. Color represents depth ranging from orange (shallow) to purple (deep). The vertical red bar on the indicate mean depth for the LME.
LME 1
East Bering Sea
Pacific Ocean
Classification: Multimodal
Dip Test: 0.014 P−value = 0
Skew: 1.89
Mean: 77.77 m

LME 2
Gulf of Alaska
Pacific Ocean
Classification: Multimodal
Dip Test: 0.018 P−value = 0
Skew: 1.32
Mean: 120.88 m

LME 3
California Current
Pacific Ocean
Classification: Shallow Dominant
Dip Test: 0.007 P−value = 0
Skew: 2.61
Mean: 96.65 m

LME 4
Gulf of California
Pacific Ocean
Classification: Shallow Dominant
Dip Test: 0.0098 P−value = 0
Skew: 1.81
Mean: 69.95 m

LME 5
Gulf of Mexico
Atlantic Ocean
Classification: Multimodal
Dip Test: 0.014 P−value = 0
Skew: 1.78
Mean: 52.57 m

LME 6
Southeast U.S. Continental Shelf
Atlantic Ocean
Classification: Multimodal
Dip Test: 0.025 P−value = 0
Skew: 3.31
Mean: 32 m
LME 7
Northeast U.S. Continental Shelf
Atlantic Ocean
Classification: Multimodal
Dip Test: 0.01 P−value = 0
Skew: 0.99
Mean: 86.49 m

LME 8
Scotian Shelf
Atlantic Ocean
Classification: Multimodal
Dip Test: 0.022 P−value = 0
Skew: 1.51
Mean: 136.01 m

LME 9
Labrador – Newfoundland
Atlantic Ocean
Classification: Mid Dominant
Dip Test: 0.0095 P−value = 0
Skew: 0.73
Mean: 178.04 m

LME 10
Insular Pacific–Hawaiian
Pacific Ocean
Classification: Shallow Dominant
Dip Test: 0.0093 P−value = 0
Skew: 4.34
Mean: 87.82 m

LME 11
Pacific Central–American Coastal
Pacific Ocean
Classification: Shallow Dominant
Dip Test: 0.0084 P−value = 0
Skew: 2.41
Mean: 87.02 m

LME 12
Caribbean Sea
Atlantic Ocean
Classification: Multimodal
Dip Test: 0.07 P−value = 0
Skew: 5.04
Mean: 34.99 m
LME 19
Greenland Sea
Atlantic Ocean
Classification: Multimodal
Dip Test: 0.015 P−value = 0
Skew: 0.67
Mean: 255.28 m

LME 20
Barents Sea
Atlantic Ocean
Classification: Multimodal
Dip Test: 0.012 P−value = 0
Skew: 0.11
Mean: 194.66 m

LME 21
Norwegian Sea
Atlantic Ocean
Classification: Multimodal
Dip Test: 0.031 P−value = 0
Skew: −0.45
Mean: 251.8 m

LME 22
North Sea
Atlantic Ocean
Classification: Multimodal
Dip Test: 0.011 P−value = 0
Skew: 2.23
Mean: 92.27 m

LME 23
Baltic Sea
Atlantic Ocean
Classification: Shallow Dominant
Dip Test: 0.0094 P−value = 0
Skew: 1.11
Mean: 53.57 m

LME 24
Celtic–Biscay Shelf
Atlantic Ocean
Classification: Shallow Dominant
Dip Test: 0.0088 P−value = 0
Skew: 2.68
Mean: 108.92 m
LME 25
Iberian Coastal
Atlantic Ocean
Classification: Shallow Dominant
Dip Test: 0.0097 P−value = 0
Skew: 6.88
Mean: 92.98 m

Depth (m)  
Area (km²)

LME 26
Mediterranean Sea
Atlantic Ocean
Classification: Multimodal
Dip Test: 0.011 P−value = 0
Skew: 5.11
Mean: 90.78 m

Depth (m)  
Area (km²)

LME 27
Canary Current
Atlantic Ocean
Classification: Multimodal
Dip Test: 0.025 P−value = 0
Skew: 2.81
Mean: 59.17 m

Depth (m)  
Area (km²)

LME 28
Guinea Current
Atlantic Ocean
Classification: Multimodal
Dip Test: 0.014 P−value = 0
Skew: 3.59
Mean: 56.41 m

Depth (m)  
Area (km²)

LME 29
Benguela Current
Atlantic Ocean
Classification: Mid Dominant
Dip Test: 0.006 P−value = 0
Skew: 0.48
Mean: 176.44 m

Depth (m)  
Area (km²)

LME 30
Agulhas Current
Indian Ocean
Classification: Shallow Dominant
Dip Test: 0.0098 P−value = 0
Skew: 2.76
Mean: 67.82 m

Depth (m)  
Area (km²)
| LME | Region                          | Ocean          | Classification   | Dip Test: 0.041 P−value = 0 | Skew   | Mean: 63.59 m |
|-----|--------------------------------|----------------|------------------|-----------------------------|--------|---------------|
| 37  | Sulu−Celebes Sea               | Pacific Ocean  | Multimodal       | 0.041                       | 2.28   |               |
| 40  | Northeast Australian Shelf      | Pacific Ocean  | Multimodal       | 0.026                       | 6.45   | 26.28 m       |
| 38  | Indonesian Sea                 | Indian Ocean   | Multimodal       | 0.011                       | 9.3    | 45.01 m       |
| 41  | East Central Australian Shelf  | Pacific Ocean  | Multimodal       | 0.013                       | 1.08   | 73.5 m        |
| 39  | North Australian Shelf          | Pacific Ocean  | Multimodal       | 0.036                       | 1.53   | 39.97 m       |
| 42  | Southeast Australian Shelf      | Pacific Ocean  | Multimodal       | 0.010                       | 2.75   | 73.33 m       |
LME 43
South West Australian Shelf
Indian Ocean
Classification: Multimodal
Dip Test: 0.011 P−value = 0
Skew: 3.29
Mean: 72.61 m

LME 44
West Central Australian Shelf
Indian Ocean
Classification: Multimodal
Dip Test: 0.018 P−value = 0
Skew: 1.34
Mean: 69.89 m

LME 45
Northwest Australian Shelf
Indian Ocean
Classification: Multimodal
Dip Test: 0.012 P−value = 0
Skew: 1.05
Mean: 64.51 m

LME 46
New Zealand Shelf
Pacific Ocean
Classification: Multimodal
Dip Test: 0.012 P−value = 0
Skew: 1.7
Mean: 102.09 m

LME 47
East China Sea
Pacific Ocean
Classification: Multimodal
Dip Test: 0.013 P−value = 0
Skew: 1.35
Mean: 83.56 m

LME 48
Yellow Sea
Pacific Ocean
Classification: Multimodal
Dip Test: 0.019 P−value = 0
Skew: 0.41
Mean: 39.41 m
LME 49
Kuroshio Current
Pacific Ocean
Classification: Shallow Dominant
Dip Test: 0.0055 P−value = 0
Skew: 1.31
Mean: 90.2 m

LME 50
Sea of Japan
Pacific Ocean
Classification: Mid Dominant
Dip Test: 0.0044 P−value = 0
Skew: 0.49
Mean: 726.13 m

LME 51
Oyashio Current
Pacific Ocean
Classification: Shallow Dominant
Dip Test: 0.0057 P−value = 0
Skew: 1.11
Mean: 88.2 m

LME 52
Sea of Okhotsk
Pacific Ocean
Classification: Multimodal
Dip Test: 0.027 P−value = 0
Skew: 0.78
Mean: 119.53 m

LME 53
West Bering Sea
Pacific Ocean
Classification: Shallow Dominant
Dip Test: 0.0092 P−value = 0
Skew: 5.54
Mean: 84.21 m

LME 54
Northern Bering – Chukchi Seas
Pacific Ocean
Classification: Multimodal
Dip Test: 0.015 P−value = 0
Skew: 3.25
Mean: 72.42 m
Figure S7. Percent change in species richness by 2° latitudinal bin along coastlines of Pacific Ocean predicted using species area relationships with a z value of 0.175 (minimum, Frank and Shackell 2001; left panels), 0.38 (mean, Levin et al. 2009; middle panels also shown in Figure 3 in the main text), and 0.62 (max, Nanami & Nishihira 2003; right panels). Each 2° depth bin is defined as a community and has the potential to lose (purple) or gain (orange) species.

| West Pacific Latitude °N | East Pacific Latitude °N | Percent Richness Change With 2° Latitudinal Shift |
|--------------------------|--------------------------|-----------------------------------------------|
|                          |                          | **z = 0.175**                                   |
|                          |                          | Loss                                           |
|                          |                          | Gain                                           |
|                          |                          | **Percent Richness Change With 2° Latitudinal Shift** |
|                          |                          | **Loss**                                       |
|                          |                          | Gain                                           |
|                          |                          | z = 0.38                                       |
|                          |                          | Loss                                           |
|                          |                          | Gain                                           |
|                          |                          | Based on the data shown in Figure 3.           |
|                          |                          | **Percent Richness Change With 2° Latitudinal Shift** |
|                          |                          | **Loss**                                       |
|                          |                          | Gain                                           |
|                          |                          | z = 0.62                                       |
|                          |                          | Loss                                           |
|                          |                          | Gain                                           |
|                          |                          | Based on the data shown in Figure 3.           |
Figure S8. Percent change in species richness by 2° latitudinal bin along west (above) and east (below) coastlines of Atlantic Ocean. See Figure S7 for more details.
Figure S9. Percent change in species richness by 2° latitudinal bin along west (above) and east (below) coastlines of Indian Ocean. See Figure S7 for more details.
Figure S10a-c. Percent change in species richness by depth predicted using species area relationships with a z value of 0.175 (minimum, Frank and Shackell 2001; a.), 0.38 (mean, Levin et al. 2009; b.), and 0.62 (max, Nanami & Nishihira 2003; c.) with a 15m (40 year) depth shift for all 64 LMEs included in the analysis. Each 15m depth bin is defined as a community and has the potential to lose (purple) or gain (orange) species.
LME 43: South West Australian Shelf

LME 44: West Central Australian Shelf

LME 45: Northwest Australian Shelf

LME 46: New Zealand Shelf

LME 47: East China Sea

LME 48: Yellow Sea
LME 62: Black Sea

LME 63: Hudson Bay Complex

LME 65: Aleutian Islands

LME 66: Canadian High Arctic – North Greenland
LME 25: Iberian Coastal

LME 26: Mediterranean Sea

LME 27: Canary Current

LME 28: Guinea Current

LME 29: Benguela Current

LME 30: Agulhas Current
LME 37: Sulu–Celebes Sea

LME 40: Northeast Australian Shelf

LME 38: Indonesian Sea

LME 41: East Central Australian Shelf

LME 39: North Australian Shelf

LME 42: Southeast Australian Shelf
Fig S10 c.

LME 1: East Bering Sea

LME 2: Gulf of Alaska

LME 3: California Current

LME 4: Gulf of California

LME 5: Gulf of Mexico

LME 6: Southeast U.S. Continental Shelf
LME 25: Iberian Coastal

LME 26: Mediterranean Sea

LME 27: Canary Current

LME 28: Guinea Current

LME 29: Benguela Current

LME 30: Agulhas Current
