What's New in *Essentials of Oceanography*, 13th Edition?

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Major improvements to *Essentials of Oceanography*, 13th Edition include:

- An emphasis on the process of science, including a new boxed "Process of Science" feature in most chapters emphasizing the scientific process by highlighting an area of oceanographic inquiry and explicitly pointing out how the process of science was used in that particular case; each feature also includes a critical thinking question "Thinking Like a Scientist: What's Next?"
- The addition to each chapter of a new "Exploring Data" feature, which directs students to engage with data and check their understanding by asking data interpretation questions related to data-rich figures, graphs, tables, and maps
- The addition in all chapters of a new "Creature Feature," which uses engaging facts about a marine organism to reinforce the theme of the chapter; each Creature Feature's title is written in an engaging "Who Am I?" format
- A stronger learning path that links the learning objectives section at the beginning of each chapter entitled "Essential Learning Concepts" directly to the end-of-section "Concept Checks" that allow and encourage students to pause and test their knowledge as they proceed through the chapter
- A new active learning pedagogy that divides chapter material into easily digestible chunks, which makes studying easier and assists student learning (cognitive science research shows that the ability to "chunk" information is essential to enhancing learning and memory)
- The addition of one or more "What Did You Learn?" assessment questions to each "Diving Deeper" boxed feature
- The continuation in each chapter of a series of SmartFigures and SmartTables, which provide a video explanation of difficult-to-understand oceanographic concepts and numerical data by an oceanography teaching expert
- Inclusion of an array of new SmartFigures/SmartTables in various chapters to maximize instructional value of the media and help students learn important content
- The continuation of the "Climate Change Connection" icon that shows how various sections relate to the overarching theme of climate change in the oceans
- The continuation of existing "Critical Thinking Questions" and "Active Learning Exercise" questions that can be used for group activities in class in all Essential Concept Review (end-of-chapter) materials
- The addition of a new "Selected Key Terms" feature in each section's end-of-chapter box that simplifies and replaces the word cloud formerly at the beginning of each chapter and directs students to the glossary at the end of the book to discover the meanings of the most important vocabulary terms that are boldfaced in each section of the text
- Removal of all footnotes; pertinent information from previous footnotes is now contained within the body of the text
- Migration of each chapter's Squidtoons call-out to Mastering Oceanography Study Area: Bonus Web Content

- Inclusion of technological advances that have resulted in the modernization of oceanographic research and continue to shape the discipline today; for example, space-based oceanographic and atmospheric observations from NASA Earth-observing satellite missions
- Expansion of the discussion of carbon and oxygen in the ocean in Chapter 5, "Water and Seawater," which includes explanation of how the distribution of dissolved gases and pH changes with depth and their significance
- Updating of information throughout the text to include some of the most recent developments in oceanography such as updated material in Chapter 16: "The Oceans and Climate Change" (ocean acidification, storm intensification, sea level rise, etc.)
- Addition of an array of new "Students Sometimes Ask…" questions throughout the book.
- An improved illustration package of new photos, satellite images, and figures to make oceanographic topics more accessible, current, and engaging
- The updating of existing figures including extensive use of annotations and labels within key figures that help direct student attention by explaining information in storyboard form
- Standardization of the color scheme and labeling of all figures to make them more appealing and consistent throughout
- Inclusion of more than 70 Web Animations from Pearson's Geoscience Animations Library, which include state-of-the-art computer animations that have been created by Al Trujillo and a panel of geoscience educators
- Addition of new Geoscience Animations that help students visualize some of the most challenging oceanographic concepts
- Inclusion of links to more than 50 hand-picked Web videos that show important oceanographic processes in action
- Inclusion of a series of studio demo and field segment videos within Mastering Oceanography that were created by author Al Trujillo; most of the studio demos were created as two-part interactive predictive videos and the field segments show real oceanographic processes in action
- Addition of QR codes embedded in the text that allow students to use their mobile devices to link directly to Mastering Oceanography Animations, SmartFigures, and Web videos
- Greater emphasis on the ocean's role in Earth systems
- Some accessory Diving Deeper features have been migrated online to Mastering Oceanography as Bonus Web Content in an effort to reduce the length of the text
- The remaining Diving Deeper features are organized around the following four themes:
  - **Historical Features**, which focus on historical developments in oceanography that tie into chapter topics.
  - **Research Methods in Oceanography**, which highlight how oceanographic knowledge is obtained.
  - **Oceans and People**, which illustrate the interaction of humans and the ocean environment.
  - **Focus on the Environment**, which emphasize environmental issues that are an increasingly important component of the book.
- All text in the chapters has been thoroughly reviewed and edited by students and oceanography instructors in a continued effort to refine the style and clarity of the writing

Specific chapter-by-chapter changes in *Essentials of Oceanography*, 13th Edition:

Preface

- An updated introduction in "To the Student"
- Inclusion of new featured drop quotes by oceanography students about the features and usefulness of the textbook

Chapter 1: Introduction to Planet "Earth"

- Updating of all historic dates from B.C. to B.C.E (before common era) and from A.D. to C.E. (common era)
- Updating of information about the possibility of oceans on other planetary bodies in our solar system
- Inclusion of a new "Students Sometime Ask…" question about how a spacecraft flyby can determine if a planetary body has an ocean below its surface
- Inclusion of a new "Creature Features" about jellies
- A revision of the section "What Is Oceanography" and a change in its title to "What Fields of Science Does Oceanography Include?"
- A major reorganization of the section "What Is the Process of Science and the Nature of Scientific Inquiry?" including a new figure illustrating the process of science, a new Process of Science feature box about why humpback whales breach, a new quote about the validity of science from astrophysicist Neil deGrasse Tyson, and a link to a UC Berkeley Website that has a more detailed description about the process of science
- A re-write on the section on evolution and the process of natural selection to add clarity
- Modification of the figure showing how photosynthesis and respiration are cyclic and complimentary processes that are fundamental to life on Earth
- Addition to the section on geologic time of how an accurate estimate of Earth's very ancient age is fundamental to the acceptance of other ideas like evolution by the science community

Chapter 2: Plate Tectonics and the Ocean Floor

- Reorganization of the section about the evidence that supports continental drift to include an integrated "Process of Science" feature that includes the evidence Wegener used to support mobile continents
- Updating of information about Earth's magnetic field based on recent satellite data
- Addition of a new "Process of Science" feature about whether sea turtles use Earth's magnetic field for navigation
- Inclusion of a new "Creature Feature" about green sea turtles
- Addition of new seismic research about a weak, partially molten layer at the base of the lithosphere that aids sliding and may reduce the force required for plate subduction
- Reorganization of the section on the stages of coral reef development, which has now been moved to Chapter 15
- Addition of a new question in Concept Check 2.4
- Rewording of some section headings to add clarity
- Updating of information in the "Students Sometimes Ask…" question about the continents coming back together to form a single landmass, including a descriptive analogy

Chapter 3: Marine Provinces

- Updated information about the 2014 missing Malaysian Airlines flight MH370 and efforts to recover its wreckage
- Addition of a new question in Concept Check 3.1
- Reorganization of the section about the continental rise including additional, new information
- Additional information about abyssal plains
- Additional description of the mid-ocean ridge
- Additional explanation about Earth's hypsographic curve (Diving Deeper 3.1)
- Additional information in the "Students Sometimes Ask…" about volcanic activity along the mid-ocean ridge affecting the ocean's surface
- Inclusion of a new "Creature Feature" about how Pacific white rays use the warmth of hydrothermal vents as nurseries for their eggs
- Addition of a new "Process of Science" feature about the unusual case of the missing sea floor seismic equipment along the East Pacific Rise north of the Galápagos Islands
- Additional description in the "Students Sometimes Ask…" question about eyewitness observation of the formation of pillow lava
- Updated information about the recently-created island Nishino-shima (south of Japan) and its continuing volcanic activity

Chapter 4: Marine Sediments

- Updated information about the Chikyu drillship and the International Ocean Discovery Program
- Expansion of details in the section on Lithogenous Sediment Texture, including real-world examples
- Inclusion of a new Creature Feature about the coccolithophore *Emiliania huxleyi*, which occurs at times in such abundance that it colors vast expanses of surface waters and can be seen from space
- Addition of a new analogy about how siliceous ooze forms on the sea floor
- Additional information about the origin of hydrogenous sediment through the presence of chemically reactive fluids
- Reorganization of the types of hydrogenous sediment, with metal sulfides now moved to the top of the list
- Updated information from NASA about the amount of space dust that reaches Earth each day
- Addition of a new "Process of Science" feature about the K–T (or K-Pg) meteoroid impact that decimated the dinosaurs about 65 million years ago
- Updated information and additional description in the section about mixtures of marine sediment
- Addition of new information about how China has extracted gas hydrates from sedimentary deposits along the continental margin in the South China Sea
- A new "Students Sometimes Ask…" question about where Himalayan sea salt comes from and why it is pink in color
- Migration of Section 11.6 "What Laws Govern Ocean Ownership?" to Mastering Oceanography Web Diving Deeper 4.2, updating of information about recent actions of the International Seabed Authority, and renaming it "Who Owns the Rights to Extract Resources from the Sea?"

Chapter 5: Water and Seawater

- A new "Students Sometimes Ask…" question about how many atoms there are in a single drop of water
- Additional clarification about how water density is affected by both thermal contraction and thermal expansion
- Inclusion of a new "Creature Feature" about narwhals, the males of which have an extended tusk that is used to measure seawater properties, including salinity
- Inclusion of information from a "Students Sometimes Ask…" question about warning labels on electrical appliances into the body of the text
- Moving the existing Diving Deeper box on goiters to Mastering Oceanography as bonus Web content
- A reorganization of material in the latter half of the chapter, including putting updated information about seawater desalination into a new Diving Deeper feature box
- Moving the information about the acid/base properties of seawater to later in the chapter
- Clarification about the term alkaline (it is an adjective, not a noun)
- Additional explanation and rewording about the ocean's carbonate buffering system
- Additional description and clarification in the "Students Sometimes Ask…" question about why carbonated beverages burn your throat when you drink them
- An entire new section (Section 5.8) entitled "What Factors Control the Distribution of Carbon in the Ocean?", including two new figures
- Addition of information about the solubility and distribution of the gases carbon dioxide and oxygen in the oceans, including how climate change is expected to impact both

Chapter 6: Air–Sea Interaction

- A new chapter-opening photo to emphasize humans' role in air-sea interaction
- Inclusion of a new "Creature Feature" about how flying fish use the lower density of air as compared to water to more easily fly above the ocean's surface
- A new, more detailed question in Concept Check 6.2
- Addition of updated information about the effect of climate change on the abundance and severity of hurricanes
- Updating of information about the record-breaking 2005 Atlantic hurricane season: Hurricanes Katrina, Rita, and Wilma
- Addition of new information about the historic 2017 Atlantic hurricane season: Hurricanes Harvey, Irma, and Maria
- Updating of information plus a new picture about how during a severe hurricane, water is withdrawn from shore, sometimes leaving shallow coastal areas dry
- Addition of a new "Process of Science" feature about whether hurricanes are good for baby dolphins
- Removal of the section on icebergs and sea ice; this has now been moved to Chapter 7
- Updating of information about newly installed wind farms

Chapter 7: Ocean Circulation

- A new beginning-of-chapter quote about the intricacies of ocean circulation by physical oceanographer Jennifer M^{c}Kinnon
- Updating of information about the Argo system of data-collecting floats, including the launch of the new Deep Argo program to collect data about the deep ocean

- A clearer link from the table listing the world's subtropical gyres to the map of ocean surface currents
- Inclusion of a new "Creature Feature" about the lion's mane jelly and the best remedy for jelly stings
- New information about Ben Franklin's 1786 chart of the Gulf Stream, which includes an inset showing migration pathways of fish in the North Atlantic Ocean
- Addition of a new "Process of Science" feature about how the marine iguanas of the Galápagos Island are adapted to the occurrence of El Niño conditions
- Addition of information about the strong 2015–2016 El Niño and comparison of it to the other strong El Niño events of 1982–1983 and 1997–1998
- An update about how climate change has impacted recent El Niño events and may be tied to background ocean warming trends
- A new section on icebergs and sea ice, which was moved from Chapter 6
- Inclusion of a new Concept Check question in Section 7.6 about the density T–S diagram (Figure 7.29)
- Updating of information about how the largest iceberg ever reported by the U.S. Navy icebreaker USS *Glacier* in 1956 were incorrect and the berg was far smaller
- Updating of information about the 2017 release of iceberg A-68 from Antarctica's Larsen Ice Shelf, including a new satellite photo of the Delaware-sized iceberg

Chapter 8: Waves and Water Dynamics

- Addition of new information and a new chapter-opening photo about a 2017 world's record that was set by Brazilian big wave surfer Rodrigo Koxa, who rode a 24-meter (80-foot) breaking wave at Praia do Norte beach near Nazaré, Portugal
- Inclusion of additional information about internal waves, including a new picture of a desktop ocean
- Addition of information about the classic study conducted in 1963 by a team of researchers led by Dr. Walter Munk at the Scripps Institution of Oceanography that tracked waves at various points across the Pacific Ocean and a link to the video of the study entitled *Waves across the Pacific*
- Clarification of some of the mathematical formulas that describe various components of waves
- Addition to Table 8.1 of real-world photos of the state of the sea for various Beaufort Wind Scale conditions
- Clarification in the section about wave dispersion regarding how long wavelength waves arrive before the shorter, choppy waves come ashore
- Addition of information in the section about spilling breakers regarding how they are the norm for open-ocean waves when gusty wind conditions cause waves to whitecap offshore
- Addition of a new "Process of Science" feature about the location of a wave's "sweet spot" to enhance surfing
- Addition of a new section about the historic Cascadia Earthquake and Tsunami of 1700, including what it could mean for future large earthquakes in the U.S. Pacific Northwest
- Updating of information about the 2011 Tohoku Earthquake and resulting tsunami off Japan

- Inclusion of a new "Creature Feature" about how Asian amur sea stars and other exotic species have been ferried across the Pacific Ocean on floating rafts of debris from the 2011 Japan tsunami

Chapter 9: Tides

- An update of the "Students Sometimes Ask…" question about how Earth tides add to the stress along faults, which makes it more likely that major earthquakes will strike at these times
- Additional clarification between centripetal and centrifugal forces
- A new "Students Sometimes Ask…" question about how the second tidal bulge forms on the far side of Earth from the Moon
- Additional clarification about how spring tides have nothing to do with the spring season; they happen twice a month during all times of the year
- Additional information about how the Moon steadied Earth's tilt, which in turn helped stabilize Earth's climate for life to flourish
- Inclusion of a new "Creature Feature" about how mudskippers are able to breathe air if they are trapped in a small pool that is depleted of dissolved oxygen when the tide goes out
- Additional information about how large tide-generating forces produce what is called a *king tide*, which is simply the very highest tide experienced only a few times a year
- Updating of information about how a tidal power plant has never been built across the Bay of Fundy because of engineering difficulties, great costs, and environmental concerns

Chapter 10: Beaches, Shoreline Processes, and the Coastal Ocean

- Inclusion of a new "Creature Feature" about how sand crabs are most often hidden beneath sandy beaches but their feathery antennae can be seen creating a V-shape in the backwash
- Addition of new paired photos to show differences between summertime and wintertime beach conditions
- Rewording of Heading 10.3 to "What Features Are Typical of Erosional and Depositional Shores?"
- Addition of a new "What Did You Learn?" question to Diving Deeper 10.1 on rip currents
- Additional clarification to describe the process of barrier island migration
- A new "Students Sometimes Ask…" question about beaches that have disappeared along U.S. coasts and if their disappearance is related to sea level rise or other environmental causes
- Incorporation of a new, up-to-date terminology to describe water mixing in estuaries and the five types of estuaries based mixing of freshwater and seawater
- Updating of information about how coastal wetlands provide both a carbon sink and protection from coastal erosion
- Addition of a new "Process of Science" feature about how recycling live Christmas trees and placing them in offshore bins is helping save coastal wetlands in Louisiana

Chapter 11: Marine Pollution

- A new chapter-opening photo by award-winning wildlife photographer Justin Hoffman of a seahorse clinging to a plastic cotton swab

- Addition of new information and a photo of the Iranian oil tanker *Sanchi*, which in 2018 collided with another vessel in the South China Sea and caused a large oil slick
- Inclusion of a new definition of toxic compound
- Updating of information about worldwide malaria infections and fatalities
- Inclusion of a new "Creature Feature" about the ocean-wide migration of Pacific bluefin tuna and if eating tuna contaminated with radioactive isotopes released from Japan's Fukushima nuclear disaster in 2011 is a significant human health hazard
- Updating of information about entanglement and ingestion of plastics by marine life, including if the plastic ingested by marine life affects humans when we eat it
- Addition of the benefits of plastics, such as how plastics save lives daily by their use in airbags, incubators, safety equipment like helmets, and for safe drinking water
- A new "Students Sometimes Ask…" question about a recently-discovered microbe that biodegrades certain types of plastics
- Updating of information about plastics, including how it's found everywhere in the ocean, new statistics of how much plastic is entering the ocean each year, what happens to it, and how long plastic takes to degrade in the ocean
- Updating of information about the increasing number of countries that have banned plastic grocery bags
- Inclusion of new information about United Nations resolution called the Clean Seas agreement that 197 nations—including the U.S.—signed in 2017
- An entire new section (Section 11.5) entitled "What Can You Do to Help Prevent Marine Pollution?", including a new Diving Deeper boxed feature "Twelve Simple Things You Can Do to Help Prevent Marine Pollution" that used to be in the Afterword
- An update of other notable examples of marine biological pollution that includes new information about (1) the red lionfish *Pterois volitans* in southeast U.S. and Caribbean coastal waters and (2) marine organisms from Japan that have been ferried across the Pacific Ocean on floating rafts of plastics and other floatables from Japan's great Tohoku Earthquake and resulting tsunami
- Migration of Section 11.6 "What Laws Govern Ocean Ownership?" to Mastering Oceanography Web Diving Deeper 4.2, updating of information about recent actions of the International Seabed Authority, and renaming it "Who Owns the Rights to Extract Resources from the Sea?"
- A new Active Learning Exercise question about invasive species in the Essential Concept Review for Section 11.6

Chapter 12: Marine Life and the Marine Environment

- Updating of information about the number and types of organisms that scientists have completed genome sequencing on
- Clarification the description concerning a working definition of life
- Clarification of information about how cyanobacteria was formerly known as blue-green algae and considered a plant
- Updating of information in the "Students Sometime Ask…" about how giant kelp is the largest protist in the world.
- Inclusion of additional description about reproduction via broadcast spawning, which involves releasing eggs and sperm directly into seawater, similar to how land plants set pollen adrift in the wind

- Additional information about how dissolved gases such as carbon dioxide and oxygen are affected by water temperature
- Inclusion of a new "Creature Feature" about the unique eyes and transparent dome of the barreleye fish
- Additional information about the characteristics of the bathypelagic and abyssopelagic zones

Chapter 13: Biological Productivity and Energy Transfer

- Updating of information in the section about measurement of primary productivity, including clarification of the history of measuring global primary productivity from Earth-orbiting satellites
- A new figure showing students using a Secchi disk to measure the clarity of water
- Simplification of the description of nitrogen recycling in the section about availability of nutrients
- Additional description about the difference between algae and true plants
- Inclusion of a new "Creature Feature" about the single-celled protozoan *Mesodinium chamaeleon* as a mixotroph
- Updating of information about the 2015 toxic diatom bloom from Monterey Bay to Puget Sound, Washington, which caused a massive die-off of sea lions, sea birds, and shellfish, all of which tested positive for domoic acid
- Updating of information about the 2017 dead zone near the mouth of the Mississippi River in the Gulf of Mexico off Louisiana, which was about the size of the state of New Jersey
- Additional clarification of what an ocean fish pen looks like by comparing it to an enclosure much like a corral on land
- Updating of information and a new figure (Figure 13.33) about world fish production that includes a new study where fisheries biologists have reconstructed the actual world catch, which includes the reported amount of fish caught plus estimates of unreported catch
- Addition of information about the contribution of worldwide marine aquaculture, which now accounts for more than 25 million metric tons (55 billion pounds) of fish
- Updating of information about the amount of bycatch produced worldwide by the fishing industry
- A new "Students Sometimes Ask…" question about why the Maine lobster fishery is experiencing a plentiful supply of lobsters
- Additional information in the section about the effect of global climate change on marine fisheries
- Addition of a new Diving Deeper feature box with updated information about ocean policy and Marine Protected Areas (MPAs), which have expanded to 3.7% of the ocean, including examples of the documented success of MPAs (moved from the former Afterword)

Chapter 14: Animals of the Pelagic Environment

- Additional clarification including detailed photos in the section about types of fins and their usage in fish
- A new figure showing actual photos of deep-water fish (not just line drawings)
- Addition of information about mixotrophs in the discussion about symbiosis

- A new "Students Sometimes Ask…" question about why whales move their broad tail-like appendage in an up-and-down motion while sharks propel themselves by moving their rear fin side-to-side
- Updating of information about manatee fatalities in Florida (as of 2017)
- Reorganization of the section about toothed whale echolocation to first present the general case of how echolocation works before examining the specific echolocation physiology of sperm whales and dolphins
- Inclusion of a new "Creature Feature" about the acrobatic behavior of humpback whales (*Megaptera novaeangliae*)
- The previous Section 14.5 on gray whale migration has been divided up into four new parts:
    - A new "Students Sometimes Ask…" question about if whales are still hunted
    - A new "Process of Science" feature about why gray whales migrate
    - A new Diving Deeper feature box on gray whales as "devilfish"
    - A new "Students Sometimes Ask…" question about whether gray whales are an endangered species

Chapter 15: Animals of the Benthic Environment

- Elimination of the discussion of diversity of species in the section on What Communities Exist along Rocky Shores?
- Proper identification of the intertidal species shown as pictures in Figure 15.2 (full-page spread)
- In the discussion on sand crabs, a callout to the new Creature Feature about sand crabs in Chapter 10
- A reorganization of the section on coral reefs that now includes additional information about how coral reefs are built, a new recap about corals, and a new section about the stages of coral reef development (including a figure and a new Concept Check question) that has been moved from Chapter 2
- A new Web video link "Lens of Time: Corals in Motion" that shows underwater time-lapse footage of corals moving around on the sea floor
- Updated information about coral bleaching events, including the damage caused by the most recent multiyear worldwide coral bleaching event during 2014–2017
- Inclusion of new information about how coral reefs are being negatively affected by the human-caused maladies of plastic trash and ocean acidification
- A new "Process of Science" feature about how coral reefs will respond to future ocean warming
- Inclusion of a new "Creature Feature" about the largest tubeworm in the world (*Riftia pachyptila*)

Chapter 16: The Oceans and Climate Change

- A new chapter-opening photo showing a large iceberg close to a population center that recently broke off a tidewater glacier in Greenland
- A new section on the carbon cycle and how it affects Earth's climate system, including a new figure and two new Concept Check questions
- Many of the figures in the chapter have been updated to include recent data

- A new "Students Sometimes Ask…" question about why plant life doesn't reduce the carbon that humans are putting into the atmosphere and convert it through photosynthesis to oxygen
- A new integrated "Process of Science" feature about whether natural processes are causing the climate change we see today
- A new figure showing the pattern of glacial/interglacial periods as part of the Milankovitch cycle of orbital variation
- Additional detail about the Deccan Traps lava flows in India and their significance
- A new "Students Sometimes Ask…" question about why scientists have been reluctant to attribute specific weather events to climate change
- Updating of information and additional certainty about the scientific consensus on climate change and a hyperlink to the 2016 Yale Climate Opinion Maps
- Addition of information and a new figure showing the cover of the 2017*Climate Science Special Report: Fourth National Climate Assessment*, which was produced at the behest of the U.S. Congress to provide an assessment of the state of science relating to climate change and its physical impacts in the United States
- A new Concept Check question for Section 16.2
- A modification of Table 16.1 to better show all pertinent greenhouse gases and include updated values
- An update to the amount of carbon dioxide humans are releasing into the atmosphere
- An update to the "Students Sometimes Ask…" question about if carbon dioxide is causing the hole in the ozone layer to include hydrofluorocarbons (HFCs) as the compounds that are replacing chlorofluorocarbons (CFCs) as a refrigerant
- An update to include recent documented changes that are occurring because of global warming
- Addition of new information about the destruction caused by Hurricanes Harvey, Irma, and Maria in 2017, including a new figures showing the flooding in Texas caused by Hurricane Harvey
- An update to the "Students Sometimes Ask…" question about whether Antarctica is actually gaining ice
- New information about the release of a Delaware-sized iceberg in July 2017 from the Antarctic Peninsula's Larsen Ice Shelf
- Inclusion of a new "Creature Feature" about how ocean acidification is dissolving the calcium carbonate shells of pteropods (family *Thecosomata*)
- An update about the advancement of the annual spring bloom in the section on the effect of global warming on marine organisms
- An entire new section about what can be done to reduce greenhouse gases, including information about the historic 2015 Paris Climate Agreement and new information about four approaches for mitigating human-caused climate change, including a new figure about a prototype wave energy converter
- Addition of a new information about what individuals can do to minimize human impact on the oceans (including former Diving Deeper Aft.1) has been moved from the former Afterword
- A call to students to "Think Like a Scientist" and critically evaluate individual choices as potential solutions to human-caused climate change

- All new questions in Concept Check 16.5

Afterword

- A modification of the layout of the Afterword to put most material within various chapters, thus shortening the Afterword to one page
- An update on the current world population of 7.6 billion people and the projection that world population will increase to between 9.6 and 12.3 billion people in 2100
- Information about ocean policy and Marine Protected Areas (MPAs) has been moved to Chapter 13
- Information about what individuals can do to minimize human impact on the oceans (including former Diving Deeper Aft.1) has been moved to Chapter 16
- Addition of a link to Sylvia Earle's TED talk on Protecting Our Oceans

Appendices

- In an effort to reduce overall page count, all Appendices have been moved online to Mastering Oceanography

Mastering Oceanography:

The new edition will include a Pearson online resource called Mastering Oceanography (www.masteringoceanography.com). Mastering is the most effective and widely-used online homework, tutorial, and assessment system in the sciences. It delivers self-paced tutorials that helps students by focusing on course objectives, providing individualized coaching, and responding to student progress.

The Study Area of Mastering Oceanography features chapter-specific Self Study Quizzes, SmartFigures/SmartTables, Oceanography Videos and Animations, Squidtoons, Dynamic Study Modules, and an optional Pearson eText with embedded videos.

Resources for Instructors:

- **Mastering Oceanography** course management system (www.masteringoceanography.com)
- **Instructor Manual** (Download Only)
- **TestGen® Computerized Test Bank** (Download Only)
- **Instructor Resource Center (IRC)** (Download Only; includes geoscience animations, PowerPoint® presentations, all art in digital format, lecture outlines, Classroom Response System questions, and digital images for transparency acetates)