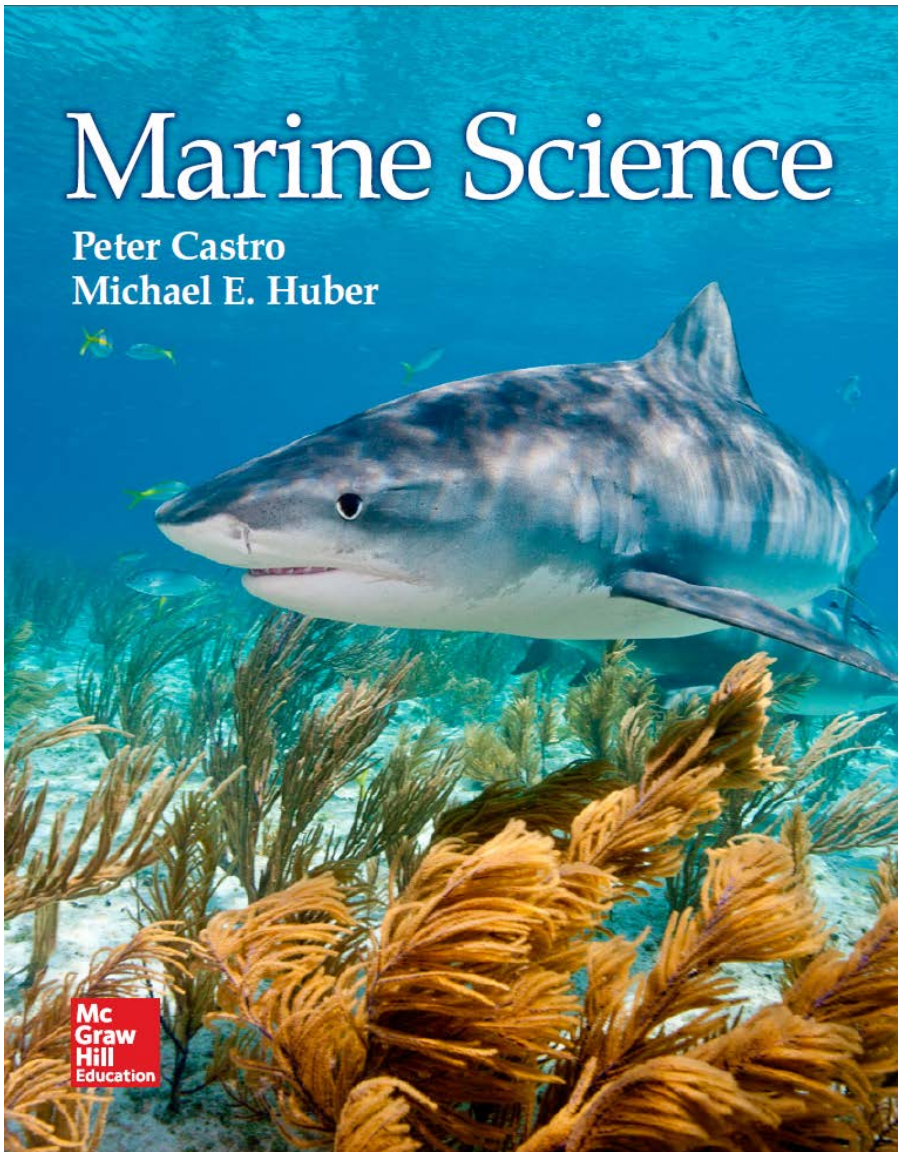
Ocean Literacy Standards
CORRELATION GUIDE
Marine Science



By Peter Castro & Michael E. Huber
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Ocean Literacy Standards Correlation
Marine Science, (1e)
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Standard	Pages
1. The Earth has one big ocean with many features.	
a. The ocean is the dominant physical feature on our planet Earth—covering approximately 70% of the planet's surface. There is one ocean with many ocean basins, such as the North Pacific, South Pacific, North Atlantic, South Atlantic, Indian and Arctic.	30, 47, 48
b. An ocean basin's size, shape and features (such as islands, trenches, mid−ocean ridges, rift valleys) vary due to the movement of Earth's lithospheric plates. Earth's highest peaks, deepest valleys and flattest vast plains are all in the ocean.	33−44, 47−55 *Dive In!* 48, 578 *Habitat Spotlight* 53
c. Throughout the ocean there is one interconnected circulation system powered by wind, tides, the force of the Earth's rotation (Coriolis effect), and water density differences. The shape of ocean basins and adjacent land masses influence the path of circulation.	93−99, 107−110, 111−112, 114−115, 116−120, 121−125, 422
d. Sea level is the average height of the ocean relative to the land, taking into account the differences caused by tides. Sea level changes as plate tectonics cause the volume of ocean basins and the height of the land to change. It changes as ice caps on land melt or grow. It also changes as sea water expands and contracts when ocean water warms and cools.	45−46, 133−134, 397, 419
e. Most of Earth's water (97%) is in the ocean and contains a constant proportion of dissolved salts (i.e. average salinity of 35). Seawater has unique properties: its freezing point is slightly lower than fresh water, its density is slightly higher, its electrical conductivity is much higher, and it is slightly basic. The salt in the water comes from eroding land, volcanic emissions, reactions at the seafloor, and atmospheric deposition.	58, 64−65, 67−72
f. The ocean is an integral part of the water cycle and is connected to all of the earth's water reservoirs via evaporation and precipitation processes.	69, 106, 108, 125, 128−129
g. The ocean is connected to major lakes, watersheds and waterways because all major watersheds on Earth drain to the ocean. Rivers and streams transport nutrients, salts, sediments and pollutants from watersheds to coastal estuaries (where rivers meet the sea) and to the ocean.	64, 69, 410, 419, 423, 451−452, 624−627, 631, 632, 636
h. Although the ocean is large, it is finite and resources are limited.	331−335, 594−595, 597−598, 642 *Humans and the Ocean* 596

2. The ocean and life in the ocean shape the features of the Earth.	
a. Many of the sedimentary rocks now exposed on land were formed in the ocean. Ocean life laid down the vast volume of siliceous and carbonate rocks.	186, 189, 190, 191, 381 *Habitat Spotlight* 36
b. Sea level changes over time have expanded and contracted continental shelves, created and destroyed inland seas, and shaped the surface of land.	45–46, 397, 419–420
c. Erosion—the wearing away of rock and soil—occurs in coastal areas as wind, waves, and currents in rivers and the ocean move sediments.	44, 410–411, 452
d. Most beach sand is carried to the coast by rivers and redistributed by waves and coastal currents. Erosion builds and destroys beaches. Winter storm waves carry sediments away from the beach and small summer waves carry sediments back onto the beaches.	Can be incorporated into the following: 87–88, 410–411, 420, 452 *Habitat Spotlight* 644
e. Tectonic activity, sea level changes, and waves influence the physical structure and landforms of the coast.	47–52, 134, 390–391, 397, 410–411, 419–420
3. The ocean is a major influence on weather and climate.	
a. The ocean controls weather and climate by dominating the Earth's energy, water and carbon systems.	72–73, 104, 106–107, 119–120, 121–123, 132
b. The ocean absorbs much of the solar radiation reaching Earth. The ocean releases heat by evaporation and this heat loss drives atmospheric circulation when heat released as water vapor condenses as rain. Condensation of water evaporated from warm seas provides the energy for hurricanes, cyclones and typhoons.	106, 108, 121–123, 128–130, 135 *Nature of Science* 27
c. The El Niño Southern Oscillation causes the most important changes in global weather patterns because it changes the way heat is released to the atmosphere in the Pacific.	120, 123–127, 477, 489
d. Most rain that falls on land originally evaporated from the tropical ocean.	Can be incorporated into the following: 108, 110, 128, 135
e. The ocean dominates the Earth's carbon cycle. Half the primary productivity on Earth takes place in the sunlit layers of the ocean and the ocean absorbs roughly half of all carbon dioxide added to the atmosphere.	72–73, 74–75, 132, 146, 376–379, 381 *Marine Science in Action* 24
f. The ocean has had, and will continue to have, a significant influence on climate change by absorbing, storing, and moving heat, carbon and water.	5, 45–46, 72–73, 74–75, 106–107, 121–127, 131–136, 381, 622
g. Changes in the ocean's circulation have produced large, abrupt changes in climate during the last 50,000 years.	120, 123–127

4. The ocean makes Earth habitable.	
a. Most of the oxygen in the atmosphere originally came from the activities of photosynthetic organisms in the ocean.	145, 179, 197 *Dive In!* 176 *Habitat Spotlight* 36
b. The ocean is the cradle of life—the first life is thought to have started in the ocean. The earliest evidence of life is found in the ocean.	Can be incorporated into the following: 5, 179, 181 *Dive In!* 176
5. The ocean supports a great diversity of life and ecosystems.	
a. Most life in the ocean exists as microbes, although ocean life ranges in size from the smallest virus to the largest animal that has lived on Earth, the blue whale.	158, 173–174, 176, 178–179, 181, 184–193, 196–201, 203, 209–213, 216–223, 225–226, 227–235, 236–243, 245–252, 253–258, 259–263, 266–270, 272–274, 303–309, 310–315, 316–323, 325–327, 329–331 *Dive In!* 159 *Habitat Spotlight* 36 *Nature of Science* 360
b. Microbial organisms are the most important primary producers in the ocean. They not only are the most abundant life form in the ocean but also have growth rates that range from hours to days.	181–182, 185, 187, 189, 429, 442–443, 520–521, 542–547, 549 *Habitat Spotlight* 36
c. Most major groups of organisms (phyla) have many representatives living in the ocean.	158, 173–174, 176–179, 181, 184–193, 198–201, 203, 209–213, 216–223, 225–226, 227–235, 236–243, 245–252, 253–258, 259–263, 266–270, 272–274, 303–309, 310–315, 316–323, 325–327, 329–331, 352
d. Ocean biology provides many unique examples of important relationships among organisms (such as symbiosis, predator–prey dynamics and energy transfer).	187, 191–192, 197, 228, 230, 234, 361–365, 367, 372–379, 461–462, 481–487, 502–505, 513–514, 539–542, 572, 578 *Dive In!* 494 *Marine Science in Action* 328, 366 *Nature of Science* 180
e. There are examples of life cycles in the ocean that are not often seen on land.	157, 185, 186, 204–205, 207, 210, 219, 221, 222, 223, 232, 233, 243, 250–252, 258, 283–284, 291–292, 294–299, 307, 308, 314–315, 348–351, 472–473, 568–570, 574 *Dive In!* 155, 228, 552
f. The ocean is three–dimensional, offering a lot of living space from the surface through the water column to the seafloor. As a result, most of the living space on Earth is in the ocean.	116–120, 368–369, 371, 517–518, 552–553, 565–566

g. Ocean habitats are defined by environmental factors. Due to interactions of abiotic factors such as salinity, temperature, oxygen, pH, light, nutrients, pressure, substratum and circulation, ocean life is not evenly distributed temporally or spatially, i.e., it is "patchy".	65, 67, 357, 368−369, 371, 378, 386−396, 397−402, 404−407, 409, 410−416, 421−422, 424−441, 451−452, 453−455, 458, 459, 466−468, 471−472, 474, 487−490, 517, 542−547, 549, 552−553, 565−566 *Dive In!* 374 *Habitat Spotlight* 460 *Marine Science in Action* 575
h. There are deep ocean ecosystems that rely only on chemical energy to support life (such as hydrothermal vents, methane cold seeps and whale falls).	181, 573, 576, 578−580 *Dive In!* 571 *Habitat Spotlight* 36, 53 Marine Science in Action 118
i. Zonation patterns of organisms along the shore are influenced by tidal ranges and waves.	369, 386−396, 410−416, 424−441 Habitat Spotlight 100
j. Coastal estuaries (where rivers meet the ocean) provide important and productive nursery areas for many marine species.	89, 419, 427, 428
6. The ocean and humans are inextricably interconnected.	
a. The ocean affects every human life. It supplies freshwater (most rain comes from the ocean) and almost all Earth's oxygen. It moderates the climate and influences our weather.	5, 104, 106−107, 119−120, 122−123, 125−127, 135−136, 517, 645 *Dive In!* 58 *Habitat Spotlight* 36
b. From the ocean we get foods, medicines, and mineral and energy resources. In addition, it provides jobs, supports our nation's economy, serves as a highway for transportation of goods and people, and plays a role in national security.	5, 186, 207−208, 270, 308, 331, 427, 444, 450, 585−594, 604−607, 612−614, 615−617 *Dive In!* 34, 142, 197, 451 *Humans and the Ocean* 202, 206 *Marine Science in Action* 611
c. The ocean is a source of inspiration, recreation, rejuvenation and discovery. It is an important element of our cultural heritage.	7−8, 331, 444, 585, 586, 610, 645 *Dive In!* 610 *Humans and the Ocean* 113
d. Most of the world's population lives in coastal areas.	134, 620−621
e. Humans affect the ocean in a variety of ways. Wastes (such as trash, sediments and sewage) enter the ocean from run off (non−point source pollution) and dumping (point source pollution). The pollution leads to habitat degradation, development of harmful algal blooms, and depletion of oxygen, as well as the endangerment, depletion, and extinction of ocean species. Coastal development, such as building structures along coasts and damming rivers leads to loss of beaches and increased coastal erosion. Through fishing, humans have removed most of the large vertebrates from the ocean, either directly or by harvesting their prey.	270, 271, 294, 308, 331−332, 334−335, 381, 444−447, 452, 463, 475−476, 490−493, 594, 595, 597−599, 607−608, 610, 613, 615, 620−623, 624−637, 638−639, 641, 645 *Dive In!* 610, 612, 621, 625 *Humans and the Ocean* 380, 522, 596 *Marine Science in Action* 24, 640 *Nature of Science* 360
f. Coastal regions (where most people live) are susceptible to natural hazards (such as tsunamis, hurricanes, cyclones, typhoons, and storm surges).	88−89, 129−130, 134, 135 *Humans and the Ocean* 90−91 *Nature of Science* 27

g. Everyone is responsible for caring for the ocean. The ocean sustains life on Earth and humans must live in ways that sustain the ocean. Individual and collective actions are needed to effectively manage ocean resources for all.	136, 271, 308, 332, 333–334, 447, 599–603, 642–645 *Dive In!* 586, 639 *Habitat Spotlight* 445, 469 *Humans and the Ocean* 609, 646 Nature of Science 360
7. The ocean is largely unexplored.	
a. The ocean is the last and largest unexplored place on Earth—less than 5% of it has been explored. This is the great frontier for the next generation's explorers and researchers, where they will find great opportunities for inquiry and investigation.	15–17, 574, 576 *Marine Science in Action* 370 *Nature of Science* 175
b. Understanding the ocean is more than a matter of curiosity. Exploration, inquiry and study are required to better understand ocean systems and processes. Our very survival may hinge upon it.	5–6, 75, 77, 123–127, 645 *Habitat Spotlight* 634
c. Over the last 40 years, use of ocean resources has increased significantly, therefore the future sustainability of ocean resources depends on our understanding of those resources and their potential.	270, 271, 586–589, 592–593, 599–603, 612–614, 638, 639, 641, 645
d. New technologies, sensors and tools are expanding our ability to explore the ocean. Oceanographers are relying more and more on satellites, drifters, buoys, subsea observatories and unmanned submersibles.	15–17, 71, 378–379, 518–519, 552, 571 *Dive In!* 539 *Habitat Spotlight* 36 *Humans and the Ocean* 577 Marine Science in Action 370 Nature of Science 12–13, 66
e. Use of computer models is now an essential part of oceanography. They help us understand the complexity of the ocean and its interaction with Earth's climate. These models process observations and help describe the interactions among systems.	89, 124–125 *Nature of Science* 27
f. Ocean exploration is truly interdisciplinary. It requires close collaboration among biologists, chemists, climatologists, computer programmers, engineers, geologists, meteorologists, and physicists, and new ways of thinking.	6 *Dive In!* 359, 518 *Habitat Spotlight* 634 *Marine Science in Action* 118, 370, 408, 548 *Nature of Science* 27, 160