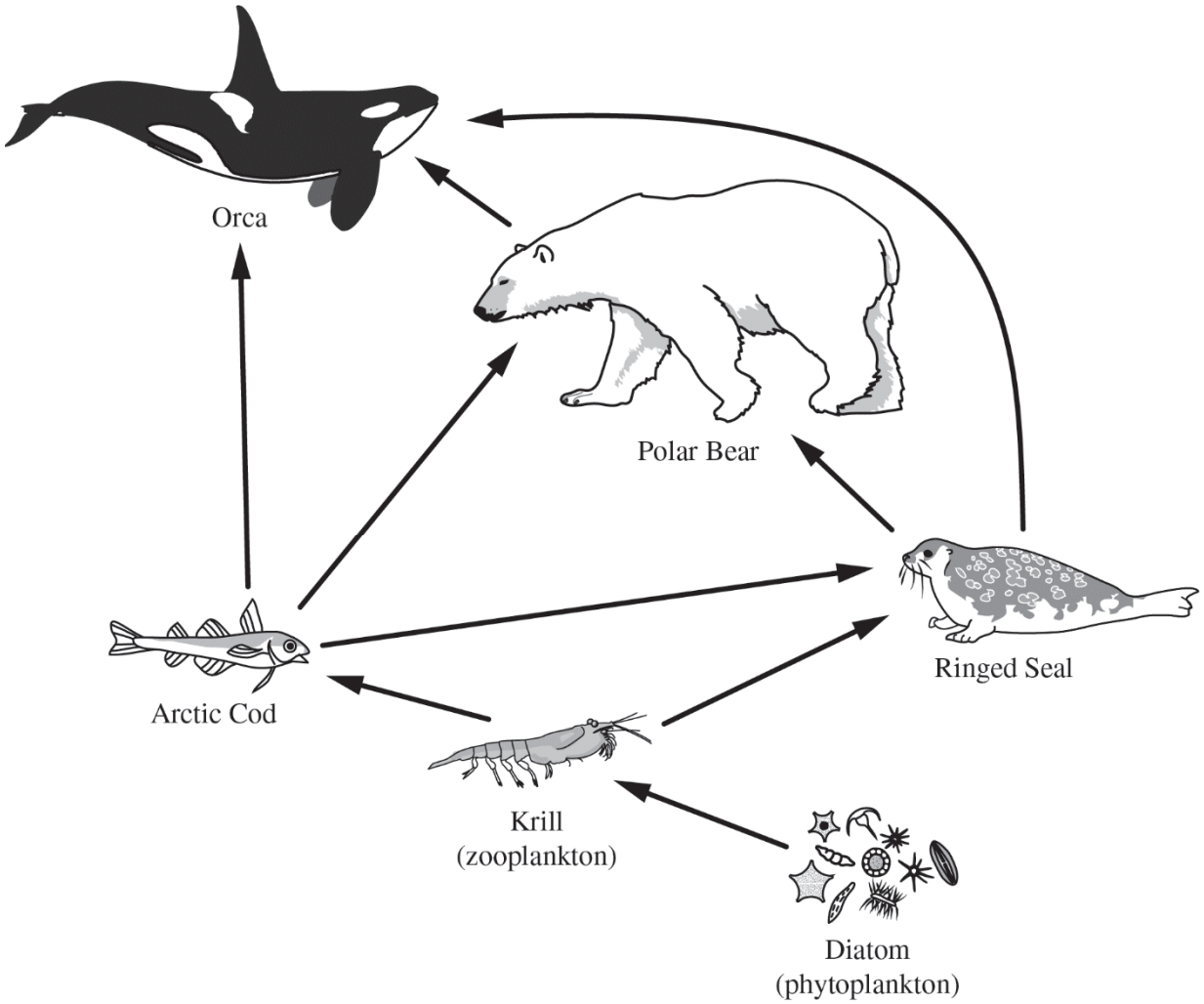
3. An Arctic food web includes the following organisms.



Note: Figures not drawn to scale.

(a) Refer to the food web above to complete the following table.

	Organism from Arctic food web
(i) **Identify** a primary producer	
(ii) **Identify** a primary consumer	
(iii) **Identify** a secondary consumer	

(b) Other than showing which organisms are consumed by other organisms, **describe** what is indicated by the direction of the arrows in the diagram.

As the amount of sea ice has decreased, larger expanses of the Arctic Ocean are now completely free of sea ice for several weeks each summer. Ringed seals, the preferred prey of polar bears, come to holes in the sea ice to breathe.

(c) **Describe** how the change in sea ice habitat is affecting polar bears' ability to hunt and feed.

(d) **Explain** how melting sea ice leads to a feedback loop that increases Arctic warming.

(e) Many species, including some whales and birds, will travel thousands of kilometers during annual migrations.

(i) **Provide** one reason a species may migrate a long distance.

(ii) The North Atlantic right whale migrates between subtropical and polar waters annually. Nearly 50 percent of right whale deaths are due to human activities. **Describe** one commercial activity, other than whaling, that may result in the death of right whales.

(iii) **Describe** one strategy that could reasonably be implemented to decrease right whale deaths caused by the commercial activity you described in part (ii).

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Question 3

An Arctic food web includes the following organisms.

(a) Refer to the diagram above to complete the following table.

(3 points; 1 point for correct identification of each organism in the table)

	Organism from Arctic food web
(i) **Identify** a primary producer	Diatom (phytoplankton)
(ii) **Identify** a primary consumer	Krill (zooplankton)
(iii) **Identify** a secondary consumer	Cod or seal

(b) Other than showing which organisms are consumed by others, **describe** what is indicated by the direction of the arrows in the diagram.

(1 point for correct description of what is indicated by the direction of the arrows)

- Shows the flow of energy among trophic levels
- Shows the flow of matter through trophic levels

As the amount of sea ice has decreased, larger expanses of the Arctic Ocean are now completely free of sea ice for several weeks each summer. Ringed seals, the preferred prey of polar bears, come to holes in the sea ice to breathe.

(c) **Describe** how the change in sea ice habitat is affecting polar bears' ability to hunt and feed.

(1 point for correct description of how the change in sea ice habitat affects ability to hunt and feed)

- Decreasing area of hunting ground (area of ice used for hauling out/fewer seal breathing holes/seals are a less available food source because of more open water) makes it more difficult for polar bears to get food
- Increasing area/distance between hunting ground means the polar bears have to exert more energy to swim to find food/physical exhaustion from swimming results in less energy available for hunting
- Increasing physiological stress (dehydration, exhaustion, cub mortality, etc.) because polar bears are not physiologically adapted to warmer temperatures
- Increasing the time between successful kills results in bears spending more time waiting/hunting for prey

Question 3 (continued)

(d) **Explain** how melting sea ice leads to a feedback loop that increases Arctic warming.

(2 points; 1 point for correct explanation of the connection between melting ice and the increased absorption of sun's energy and 1 point for correct explanation that increased absorption of sun's energy leads to increased melting of ice. For the second point the student must complete the positive feedback loop.)

- Melting of sea ice leads to a decrease in albedo, or reflectivity, leads to water surfaces absorbing more of the sun's energy.

AND

- Increasing absorption of sun's energy warms the water surface further, which leads to further ice melt (completes positive feedback loop).

(e) Many species, including some whales and birds, will travel thousands of kilometers during annual migrations.

(i) **Provide** one reason a species may migrate a long distance.

(1 point for a correct reason why a species may migrate a long distance)

- Limited food/water supply leads to migration to locations with more food/water supply
- Food supply migrates and species follow prey
- More hospitable climate during certain seasons
- Availability of mates/breeding/birthing occurs in different location
- Protection of offspring from predators

Question 3 (continued)

(ii) The North Atlantic right whale migrates between subtropical and polar waters annually. Nearly 50 percent of right whale deaths are due to human activities. **Describe** one commercial activity, other than whaling, that may result in the death of right whales.

(1 point for correct description of one commercial activity, other than whaling)

(iii) **Describe** one strategy that could reasonably be implemented to decrease right whale deaths caused by the commercial activity you described in part (ii).

(1 point for correct strategy linked to activity in (ii))

Description of commercial activity	Description of one strategy
• Fishing nets entangle whales as by-catch. • Fishing gear can accidently trap.	• Require change of fishing method (location, timing, or materials) that traps whales to reduce the number of whales trapped in nets/gear • Fines for discarded fishing gear (long-line gear, ropes for hauling pots up, etc.) so less gear is discarded reducing the number of whales trapped in gear
• Ships and whales use the same channels, which can increase number of ship strikes.	• Improved navigational technology to spot whales that are close to ships in order to avoid collisions • Increased education of ship captains and crews about whale habitat/migration routes/feeding behaviors in order to reduce ship collisions with whales • Expansion of low-speed navigational zones around ports to reduce ship collisions with whales
• Noise pollution from seismic surveys/sonar/engine noise can disrupt a whale's internal navigational system.	• Reduction of seismic survey activity/sonar use in coastal areas to reduce exposure to noise pollution • Installation of quieter motors to reduce or eliminate noise pollution