*You should spend about 20 minutes on **Questions 28–40**, which are based on Reading Passage 3.*

*Read the text below and answer **Questions 28–40**.*

Urban fish farming

New initiatives are making the widespread farming of fish in cities a real possibility.

It is estimated that the world's population will have reached 8 billion people by the year 2030, which is a matter of concern in terms of the global food supply. It is thought that by then, only 38% of seafood consumed will come from wild sea life, meaning that the rest will be sourced from fish farming. Using a system called aquaponics however, it is possible to cultivate both fish and produce (e.g. vegetables) in a closed-loop system. The fish waste fertilises the plants and the plants purify the water making it habitable for the fish. This idea has been used in fish farming for years; recently however, there have been some initiatives that are using aquaponics in a city environment.

Many offshore fish farms are experiencing a number of issues. Often, the waters where they are located are becoming less attractive as habitats because the water is getting warmer and, therefore, has higher levels of acidity. In addition to this, this type of farming often relies on antibiotics and pesticides. Leftover fish waste can pollute the area and have a negative effect on other species. These reasons have led researchers and entrepreneurs to investigate alternative ways of farming fish.

New York scientist Martin Schreibman keeps fish in large tanks in his laboratory – a very different set-up from a conventional fish farm or, for that matter, from a natural ecosystem. He has been working on a system that eliminates the use of chemicals in the rearing of the fish. This system filters water from the tap and removes waste created by the fish. No antibiotics or pesticides are added but he is able to control the temperature of the water and has had particular success with tilapia fish, which he says are ideal for research thanks to their resilience. By making his recirculation system sufficiently compact that it can be operated using the city water supply, Schreibman believes tanks like his could be used on city rooftops to provide residents with fish all year round.

The idea behind aquaponics is far from new. As far back as 1,000 BC farmers in China realised they were able to boost the yield from their rice paddies when they let fish swim in the water around the rice and fertilise the plants with their waste. Jason Green explains that his company, Edenworks, wants to adapt that early knowledge, which used an ecosystem that was already there, to the modern situation where the ecosystem can be separate and independent from the land. He notes that the challenge is to create soil that has the same richness and nutrient support as a natural system has.

In trying to recreate the right balance to produce delicious food, Edenworks monitors all conditions on the farms using sensors. The company has enlisted the help of professional chef and now Edenworks' Head of Product, Sam Yoo, to sample the food once it is harvested. Yoo uses his highly-trained palette to help quantify aspects of the food like flavour and texture.

One notable feature of Edenworks farms is that they use a vertical design. This enables them to grow up to six times as much produce in the same sized space as other systems. They do not use LED or fluorescent lights, preferring instead a solar design. Currently they sell produce and fish directly to restaurants, but Green explains Edenworks would like to get to a point where the aquaponic model of food production is integrated into building design from the start. He adds that besides providing food, a rooftop farm serves as a layer of insulation for the building, thus benefitting the occupants in additional ways.

There are undoubted benefits of urban farming for the environment. The average item in an American grocery story currently travels 1500 miles on its way to the shelf. Producing food in cities would not only vastly reduce the energy required for distribution but would also have a positive effect on how fresh and nutritious the fruits and vegetables in local communities are.

Neil Sims of Kampachi Farms has been deeply involved in the fish-farming industry, though off the coast of Hawaii rather than in cities. Sims and his colleagues have found that they have had to overcome the public perception of farmed fish or fish grown in a warehouse as being somehow inferior nutritionally. He acknowledges that some poorly-executed attempts at fish farming in the past may have made people sceptical but notes that the resistance should be countered with the possibility of a sustainable, healthy source of fish. As Sims points out, if the number of people on Earth approaches the expected 11 billion at the end of the century, there will simply not be enough fish to feed everyone. That is, of course, unless a new way of supplying fish is adopted.

Talkers

Questions 37–40

Complete the summary below.

*Choose **ONE WORD ONLY** from the text for each answer.*

Write your answers in boxes 37–40 on your answer sheet.

Bringing back an old concept

From 1,000 BC Chinese rice farmers made use of aquaponics, which helped them to increase their **37** ..... They allowed fish into the rice paddies and the **38** ..... from the fish naturally enriched their crops. Edenworks is looking at ways to incorporate that idea, but with a system that is not connected to the **39** ..... They are trying to find a way to produce food that tastes great by duplicating the qualities of **40** ..... found in nature.