Reading 52
Keep a Watchful Eye on the Bridges

A.

Most road and rail bridges are only inspected visually, if at all. Every few months, engineers have to clamber over the structure in an attempt to find problems before the bridge shows obvious signs of damage. Technologies developed at Los Alamos National Laboratory, New Mexico, and Texas A&M University may replace these surveys with microwave sensors that constantly monitor the condition of bridges.

B.

“The device uses microwaves to measure the distance between the sensor and the bridge, much like radar does,” says Albert Migliori, a Los Alamos physicist “Any load on the bridge – such as traffic induces displacements, which change that distance as the bridge moves up and down.” By monitoring these movements over several minutes, the researchers can find out how the bridge resonates. Changes in its behaviour can give an early warning of damage.

C.

The Interstate 40 bridge over the Rio Grande river in Albuquerque provided the researchers with a rare opportunity to test their ideas. Chuck Farrar, an engineer at Los Alamos, explains: “The New Mexico authorities decided to raze this bridge and replace it. We were able to mount instruments on it, test it under various load conditions and even inflict damage just before it was demolished.” In the 1960s and 1970s, 2500 similar bridges were built in the US. They have two steel girders supporting the load in each section. Highway experts know that this design is “fracture critical” because a failure in either girder would cause the bridge to fail.

D.

After setting up the microwave dish on the ground below the bridge, the Los Alamos team installed conventional accelerometers at several points along the span to measure its motion. They then tested the bridge while traffic roared across it and while subjecting it to pounding from a “shaker”, which delivered precise punches to a specific point on the road.

E.

“We then created damage that we hoped would simulate fatigue cracks that can occur in steel girders,” says Farrar. They first cut a slot about 60 centimetres long in the middle of one girder. They then extended the cut until it reached the bottom of the girder and finally they cut across the flange – the bottom of the girder’s “I” shape.

F.

The initial, crude analysis of the bridge’s behaviour, based on the frequency at which the bridge resonates, did not indicate that anything was wrong until the flange was damaged. But later the data were reanalysed with algorithms that took into account changes in the mode shapes of the structure – shapes that the structure takes on when excited at a particular frequency. These more sophisticated algorithms, which were developed by Norris Stubbs at Texas A&M University, successfully identified and located the damage caused by the initial cut.

G.

“When any structure vibrates, the energy is distributed throughout with some points not moving, while others vibrate strongly at various frequencies,” says Stubbs. “My algorithms use pattern recognition to detect changes in the distribution of this energy.” NASA already uses Stubbs’ method to check the behaviour of the body flap that slows space shuttles down after they land.

H.

A commercial system based on the Los Alamos hardware is now available, complete with the Stubbs algorithms, from the Quatro Corporation in Albuquerque for about $100,000. Tim Darling, another Los Alamos physicist working on the microwave interferometer with Migliori, says that as the electronics become cheaper, a microwave inspection system will eventually be

applied to most large bridges in the US. “In a decade I would like to see a battery or solar-powered package mounted under each bridge, scanning it every day to detect changes,” he says.

Questions 1-4

Choose the correct letter out of the options, A, B, C or D.

Write your answers in boxes 1-4 on your answer sheet.

1. How did the traditional way to prevent damage to the bridges before the invention of the new monitoring system

A. Bridges have to be tested in every movement on two points.
B. Bridges have to be closely monitored by microwave devices.
C. Bridges have already been monitored by sensors.
D. Bridges have to be frequently inspected by professional workers with naked eyes.

2. How does the new microwave monitors find out the problems of bridges

A. by changeling the distance between the positions of devices
B. by controlling the traffic flow on the bridges
C. by monitoring the distance caused by traffic between two points
D. by displacement of the several critical parts in the bridges

3. Why did the expert believe there is a problem for the design called “fracture critical”

A. Engineers failed to apply the newly developed construction materials.
B. There was not enough finance to repair the bridges.
C. The supporting parts of the bridges may crack and cause the bridge to fail.
D. There were bigger traffic load conditions than the designers had anticipated.

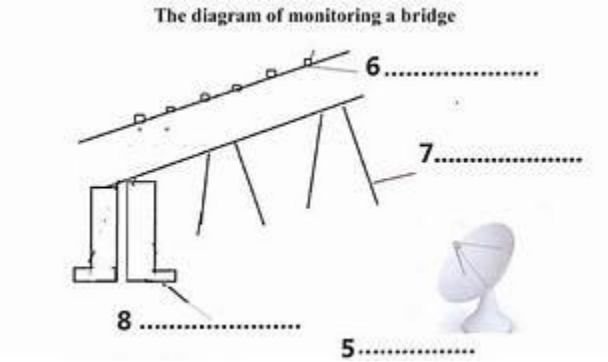
4. The defect was not recognized by a basic method in the beginning

A. until the mid of faces of bridges has fractured.
B. until the damage appears along and down to the flanges.
C. until the points on the road have been punched.
D. until the frequency of resonates appears disordered.

Questions 5-8

Write the correct answer in boxes 5-8 on your answer sheet.

The Diagram of Monitoring a Bridge



Questions 9-13

The reading Passage has eight paragraphs, A–H.

Which paragraph contains the following information?

Write the correct letter, A-H, in boxes 9-13 on your answer sheet.

9. how is the pressure that they have many a great chance to test bridges
10. a ten-year positive change for microwave device
11. the chance they get an honourable contract
12. explanation of the mechanism for the new microwave monitoring to work
13. how the damage was deliberately created by the researchers

The economic importance of coral reefs

A lot of people around the world are dependent, or partly dependent, on coral reefs for their livelihoods. They often live adjacent to the reef, and their livelihood revolves around the direct extraction, processing and sale of reef resources such as shell fish and seaweeds. In addition, their homes are sheltered by the reef from wave action.

Reef flats and shallow reef lagoons are accessible on foot, without the need for a boat, and so allow women, children and the elderly to engage directly in manual harvesting, or 'reef-gleaning'. This is a significant factor distinguishing reef-based fisheries from near-shore sea fisheries. Near-shore fisheries are typically the domain of adult males, in particular where they involve the use of boats, with women and children restricted mainly to shore-based activities. However, in a coral-reef fishery the physical accessibility of the reef opens up opportunities for direct participation by women, and consequently increases their independence and the importance of their role in the community. It also provides a place for children to play, and to acquire important skills and knowledge for later in life. For example, in the South West Island of Tobi, in the Pacific Ocean, young boys use simple hand lines with a loop and bait at the end to develop the art of fishing on the reef. Similarly, in the Surin Islands of Thailand, young Moken boys spend much of their time playing, swimming and diving in shallow reef lagoons, and in doing so build crucial skills for their future daily subsistence.

Secondary occupations, such as fish processing and marketing activities, are often dominated by women, and offer an important survival strategy for households with access to few other physical assets (such as boats and gear), for elderly women, widows, or the wives of infirm men. On Ulithi Atoll in the western Pacific, women have a distinct role and rights in the distribution of fish catches. This is because the canoes, made from mahogany logs from nearby Yap Island, are obtained through the exchange of cloth made by the women of Ulithi. Small-scale reef fisheries support the involvement of local women traders and their involvement can give them greater control over the household income, and in negotiating for loans or credit. Thus their role is not only important in providing income for their families, it also underpins the economy of the local village.

Poor people with little access to land, labour and financial resources are particularly reliant on exploiting natural resources, and consequently, they are vulnerable to seasonal changes in the availability of those resources. The diversity of coral reef fisheries, combined with their physical accessibility and the protection they provide against bad weather, make them relatively stable compared with other fisheries, or land-based agricultural production.

In many places, the reef may even act as a resource bank, used as a means of saving food for future times of need. In Manus, Papua New Guinea, giant clams are collected and held in walled enclosures on the reef, until they are needed during periods of rough weather. In Palau, sea cucumbers are seldom eaten during good weather in an effort to conserve their populations for months during which rough weather prohibits good fishing.

Coral reef resources also act as a buffer against seasonal lows in other sectors, particularly agriculture. For example, in coastal communities in northern Mozambique, reef harvests provide key sources of food and cash when agricultural production is low, with the peak in fisheries production coinciding with the period of lowest agricultural stocks. In Papua New Guinea, while agriculture is the primary means of food production, a large proportion of the coastal population engage in sporadic subsistence fishing.

In many coral-reef areas, tourism is one of the main industries bringing employment, and in

many cases is promoted to provide alternatives to fisheries-based livelihoods, and to ensure that local reef resources are conserved. In the Caribbean alone, tours based on scuba-diving have attracted 20 million people in one year. The upgrading of roads and communications associated with the expansion of tourism may also bring benefits to local communities. However, plans for development must be considered carefully. The ability of the poorer members of the community to access the benefits of tourism is far from guaranteed, and requires development guided by social, cultural and environmental principles. There is growing recognition that sustainability is a key requirement, as encompassed in small-scale eco-tourism activities, for instance.

Where tourism development has not been carefully planned, and the needs and priorities of the local community have not been properly recognised, conflict has sometimes arisen between tourism and local, small-scale fishers.

Questions 14-20

Do the following statements agree with the information given in Reading Passage ?

TRUE if the statement agrees with the information
FALSE if the statement contradicts the information
NOT GIVEN if there is no information on this

14. In most places, coral-reef gleaning is normally carried out by men.
15. Involvement in coral-reef-based occupations raises the status of women.
16. Coral reefs provide valuable learning opportunities for young children.
17. The women of Ulithi Atoll have some control over how fish catches are shared out.
18. Boats for use by the inhabitants of Ulithi are constructed on Yap Island.
19. In coral reef fisheries, only male traders can apply for finance.
20. Coral reefs provide a less constant source of income than near-shore seas.

Questions 21-26

Complete the notes below.

Choose **NO MORE THAN TWO WORDS** from the passage for each answer.

How coral-reef-based resources protect people during difficult times

Coral reefs can provide

- a resource bank, e.g. for keeping clams and **21 .....**
- a seasonal back-up, when **22 .....**. products are insufficient,e.g. in northern Mozambique.

- a tourist attraction, e.g. **23 .....** tours in the Caribbean.

Benefits for local people include:

- The creation of jobs.
- Improvements to roads and **24 .....**

Important considerations:

- Development must be based on appropriate principles.
- Need for **25 .....**

Poorly-planned development can create **26 .....** with local fishers.

The Future of fish

The face of the ocean has changed completely since the first commercial fishers cast their nets and hooks over a thousand years ago. Fisheries intensified over the centuries, but even by the nineteenth century it was still felt, justifiably, that the plentiful resources of the sea were for the most part beyond the reach of fishing, and so there was little need to restrict fishing or create protected areas. The twentieth century heralded an escalation in fishing intensity that is unprecedented in the history of the oceans, and modern fishing technologies leave fish no place to hide. Today, the only refuges from fishing are those we deliberately create. Unhappily, the sea trails far behind the land in terms of the area and the quality of protection given.

For centuries, as fishing and commerce have expanded, we have held onto the notion that the sea is different from the land. We still view it as a place where people and nations should be free to come and go at will, as well as somewhere that should be free for us to exploit. Perhaps this is why we have been so reluctant to protect the sea. On land, protected areas have proliferated as human populations have grown. Here, compared to the sea, we have made greater headway in our struggle to maintain the richness and variety of wildlife and landscape. Twelve percent of the world's land is now contained in protected areas, whereas the corresponding figure for the sea is but three-fifths of one percent. Worse still, most marine protected areas allow some fishing to continue. Areas off-limits to all exploitation cover something like one five-thousandth of the total area of the world's seas.

Today, we are belatedly coming to realise that 'natural refuges' from fishing have played a critical role in sustaining fisheries, and maintaining healthy and diverse marine ecosystems. This does not mean that marine reserves can rebuild fisheries on their own - other management measures are also required for that. However, places that are off-limits to fishing constitute the last and most important part of our

package of reform for fisheries management. They underpin and enhance all our other efforts. There are limits to protection though.

Reserves cannot bring back what has died out. We can never resurrect globally extinct species, and restoring locally extinct animals may require reintroductions from elsewhere, if natural dispersal from remaining populations is insufficient. We are also seeing, in cases such as northern cod in Canada, that fishing can shift marine ecosystems into different states, where different mixes of species prevail. In many cases, these species are less desirable, since the prime fishing targets have gone or are much reduced in numbers, and changes may be difficult to reverse, even with a complete moratorium on fishing. The Mediterranean sailed by Ulysses, the legendary king of ancient Greece, supported abundant monk seals, loggerhead turtles and porpoises. Their disappearance through hunting and overfishing has totally restructured food webs, and recovery is likely to be much harder to achieve than their destruction was. This means that the sooner we act to protect marine life, the

more certain will be our success.

To some people, creating marine reserves is an admission of failure. According to their logic, reserves should not be necessary if we have done our work properly in managing the uses we make of the sea. Many fisheries managers are still wedded to the idea that one day their models will work, and politicians will listen to their advice. Just give the approach time, and success will be theirs. How much time have we got? This approach has been tried and refined for the last 50 years. There have been few successes which to feather the managers' caps, but a growing litany of failure. The Common Fisheries Policy, the European Union's instrument for the management of fisheries and aquaculture, exemplifies the worst pitfalls: flawed models, flawed advice, watered-down recommendations from government bureaucrats and then the disregard of much of this advice by politicians. When it all went wrong, as it inevitably had to, Europe sent its boats to other countries in order to obtain fish for far less than they were actually worth.

We are squandering the wealth of oceans. If we don't break out of this cycle of failure, humanity will lose a key source of protein, and much more besides. Disrupting natural ecosystem processes, such as water purification, nutrient cycling, and carbon storage, could have ramifications for human life itself. We can go a long way to avoiding this catastrophic mistake with simple common sense management. Marine reserves lie at the heart of the reform. But they will not be sufficient if they are implemented only here and there to shore up the crumbling edifice of the 'rational fisheries management' envisioned by scientists in the 1940s and 1950s. They have to be placed centre stage as a fundamental underpinning for everything we do in the oceans. Reserves are a first resort, not a final resort when all else fails.

Questions 27-31
Do the following statements agree with the views of the writer in Reading Passage?
Write
YES if the statement agrees with the claims of the writer
NO if the statement contradicts the claims of the writer
NOT GIVEN if it is impossible to say what the writer thinks about this

27 It is more than a thousand years since people started to catch fish for commercial use.

28 In general, open access to the oceans is still regarded as desirable.

29 Sea fishing is now completely banned in the majority of protected areas.

30 People should be encouraged to reduce the amount of fish they eat.

31 The re-introduction of certain mammals to the Mediterranean is a straightforward task.

Questions 32-34
Choose the correct letter, A, B, C or D.

32 What does the writer mean with the question, 'How much time have we got?' in the fifth paragraph?

A Fisheries policies are currently based on uncertain estimates.
B Accurate predictions will allow governments to plan properly.
C Fisheries managers should provide clearer information.
D Action to protect fish stocks is urgently needed.

33 What is the writer's comment on the Common Fisheries Policy?

A Measures that it advocated were hastily implemented.
B Officials exaggerated some of its recommendations.
C It was based on predictions which were inaccurate.
D The policy makers acquired a good reputation.

34 What is the writer's conclusion concerning the decline of marine resources?

A The means of avoiding the worst outcomes needs to be prioritised.
B Measures already taken to avoid a crisis are probably sufficient.
C The situation is now so severe that there is no likely solution.
D It is no longer clear which measures would be most effective.

Questions 35-40
Complete the summary using the list of words/phrases, A-J, below.

Measures to protect the oceans
Up till the twentieth century the world's supply of fish was sufficient for its needs.

It was unnecessary to introduce 35 _____ of any kind, because large areas of the oceans were inaccessible.

However, as 36 _____ improved, this situation changed, and in the middle of the twentieth century, policies were introduced to regulate 37 _____.

These policies have not succeeded. Today, by comparison with 38 _____ the oceans have very little legal protection.

Despite the doubts that many officials have about the concept of 39 _____, these should be at the heart of any action taken.

The consequences of further 40 _____ are very serious, and may even affect our continuing existence.

A action
B controls
C failure
D fish catches
E fish processing
F fishing techniques
G large boats
H marine reserves
I the land
J the past