2017

The APRU and The New York Times Asia-Pacific Case Competition

The Future of the Pacific Ocean

Top 10 Case Submissions

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The New York Times

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About APRU and The New York Times

APRU is the network of leading universities linking the Americas, Asia and Australasia. We bring together thought leaders, researchers, and policy-makers to exchange ideas and collaborate on effective solutions to the challenges of the 21st century. The Association of Pacific Rim Universities is the Voice of Knowledge and Innovation for the Asia-Pacific region.

Sustaining the Pacific Ocean is critical for the future of the planet. APRU has registered its voluntary commitment to the United Nations Sustainability Development Goal 14: Conserve and sustainably use the oceans, seas and marine resources for sustainable development.

APRU is committed to:
1) Raising awareness and encouraging future leaders in the Asia-Pacific to engage with problems the Pacific Ocean faces through annual student-focused activities in collaboration with international partners.
2) Supporting capacity building across the Asia-Pacific by developing a network of research centers and experts across disciplines, facilitating best practice sharing and cross disciplinary collaborations.
3) Building an effective platform connecting latest research and experts across the Asia-Pacific with policy makers and international organizations actively facilitating policy development and implementation.

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Introduction

The inaugural APRU - The New York Times Case Competition attracted entries from some of the brightest minds in the Americas, Asia and Australasia to tackle a pressing issue: The Future of the Pacific Ocean.

I wish to congratulate the winners from The University of Washington in Seattle, Katherine Crosman, Leah Johnson, Eleni Petrou and Hillary Scannell; and the runners-up from Yale-NUS College and the National University of Singapore, Stephanie Chee and Nicole Lim Pei Pey.Coming from both sides of the Pacific Ocean, they demonstrate the importance of this issue to diverse communities linked by this great ocean.

I also wish to acknowledge the other entrants from 12 nations and territories and 31 universities. It was a privilege to have such a talented field from which to select. It is no easy task to focus a policy response to the complexities of climate change in 800 words.

As an association of the leading research universities around the Pacific Rim, APRU is addressing a sustainability issue critical for every society in the region and, indeed, as the world's largest ocean, critical for the whole planet.

By engaging students in a case competition which aims to brief public policy leaders, we hope to strengthen long term leadership of climate change mitigation and adaptation, ocean sustainability and governance, disaster science and recovery as well as oceanographic and environmental research and education.

APRU has registered voluntary commitments to United Nations Sustainability Development Goal (SDG) 14: Conserve and sustainably use the oceans, seas and marine resources for sustainable development (See http://bit.ly/2rLEuWm).

We are most grateful for The New York Times' partnership and for publishing the winners' article in its international edition.

I would also like to thank the judges from The New York Times' award-winning newsroom, Ms Sarah Anderson, Senior Staff Editor, and Mr Dean Napolitano, Freelance Journalist; and Professor Cindy Fan, Vice Provost for International Studies and Global Engagement, UCLA, and Professor Gretchen Kalonji, Dean, Institute for Disaster Management and Reconstruction, Sichuan University.

As the voice of knowledge and innovation in the Pacific, APRU will continue to use our unique geographical reach to bring together the region's leaders and brightest minds to address the future of the world's greatest ocean.

Dr Christopher Tremewan
Secretary General
Association of Pacific Rim Universities

Top 10
Case Submissions

Winner

1st Runner-up

2nd Runner-up

Winner

Safeguarding U.S. West Coast Communities from a Warming Climate

University of Washington
Katherine Crosman, Leah Johnson, Eleni Petrou, Hillary Scannel

The U.S. West Coast is home to vibrant coastal communities deeply connected to the Pacific Ocean. For example, coastal marine living resources, tourism and recreation in California, Oregon and Washington provided 150,000 jobs and brought in $25bn in gross domestic product in 2013 alone[1].

In 2015, however, feverish conditions in the Pacific Ocean threatened the West Coast. Unusually warm waters encouraged the rapid growth of the toxic algae, Pseudo-nitzchia australis, producing domoic acid. Consuming foods contaminated with domoic acid causes illness, and even death, in humans, seabirds, and marine mammals.

In order to protect public health, lucrative fisheries are routinely closed for short spells in response to harmful algal blooms (HABs). However, the unprecedented scale and duration of the 2015 HAB led to widespread and protracted closures of California, Oregon, and Washington coastal fisheries[2] and took its toll on the wider marine ecosystem, causing mass mortality in seabirds, pinnipeds and sea otters (Figure 1). The total economic losses from this event have yet to be quantified, but early evidence suggests widespread losses in income for fisheries and tourism[3].

The 2015 HAB grimly foreshadows the future. Highly developed climate models predict that Pacific waters will continue to warm, creating conditions similar to the catastrophic events in 2015. More frequent, longer lasting and widespread HABs are likely. However, HAB policy responses are complicated by the unpredictable timing, extent and duration of blooms, and a lack of coordinated monitoring, information sharing, and action.

The policy measures recommended here are grounded in one simple goal: continue to protect public health while sustaining vibrant West Coast communities. To accomplish this goal, we provide three linked recommendations: (1) establish networks that connect managers, science, and users, (2) establish formal systems to mitigate the economic effects of HABs, and (3) coordinate on-going regional information-sharing and policy.

(1) **Connecting science, users and management:** A network of coastal monitoring currently exists from southern California through the Pacific Northwest as a part of NOAA's integrated ocean observing system (https://ioos.noaa.gov/). In addition to these efforts, NOAA works with researchers at West Coast universities and institutions to develop sophisticated HAB models[4]. These models can identify conditions that warrant increased field sampling for marine toxins.

We suggest building on existing efforts by instituting reliable, standardized pathways to transfer information between scientists and managers, and creating an automated system whereby toxin thresholds trigger an alert disseminated to policy makers, informing them of the possibility of a significant HAB. Additionally, existing modeling efforts should be advanced and integrated to create a single unifying forecasting system along the U.S. West Coast. Finally, to extend existing monitoring efforts, and to create stakeholder awareness of HABs, we recommend the establishment of a web-based clearinghouse that encourages coastal communities to participate in ocean monitoring by providing a forum to share on-the- ground observations of coastal conditions (e.g. [5,6]). These efforts can be coordinated under the aegis of the tri-state body proposed in recommendation (3) (Figure 2). This sophisticated network of monitoring and forecasts will provide policy-makers, managers, and the fishing and tourism industries with warning of potential HAB events.

(1) **Economic mitigation:** Commercial, tribal and recreational communities can all be devastated by HAB events. Currently, however, no coherent system of economic mitigation exists to assist these vulnerable communities: although fisheries may request fisheries-specific assistance through NOAA, federal funds are likely to be scarcer in at least the near term. The coordinating body outlined in recommendation (3) should research alternate funding sources for mitigation of HAB-related economic impacts. Fruitful avenues might include federal disaster relief funds, state general funds, industry contributions, or even alternate livelihood support (for example, fishers subject to a closure are given work removing poisoned marine mammal carcasses from tourist beaches). Once funds for economic mitigation are identified, systems delineating dissemination of funds should be implemented; these should coordinate with the automated alert system outlined in recommendation (1).

(2) **Regional coordination:** HABs know no boundaries and their effects are widespread across the U.S. West Coast. We recommend the establishment of a tri-state regional coordinating body to promote information sharing, especially the sharing of predictive and real-time monitoring of ocean conditions and nascent or existing HABs (Figure 2). Existing HAB responses, as well as our recommended actions, take place within disparate agencies, at different levels of government, and across federal/tribal boundaries. To efficiently and effectively share information, reduce duplicate effort, and coordinate complementary HAB responses, this panel should consist of state-level policy-makers and managers.

In sum, these recommendations

continue to protect public health while sustaining vibrant coastal communities by improving HAB prediction, better disseminating HAB information to decision-makers and affected stakeholders, identifying funding, and designing systems for economic mitigation of HAB effects, all within a coordinated region-wide framework for HAB monitoring and response.

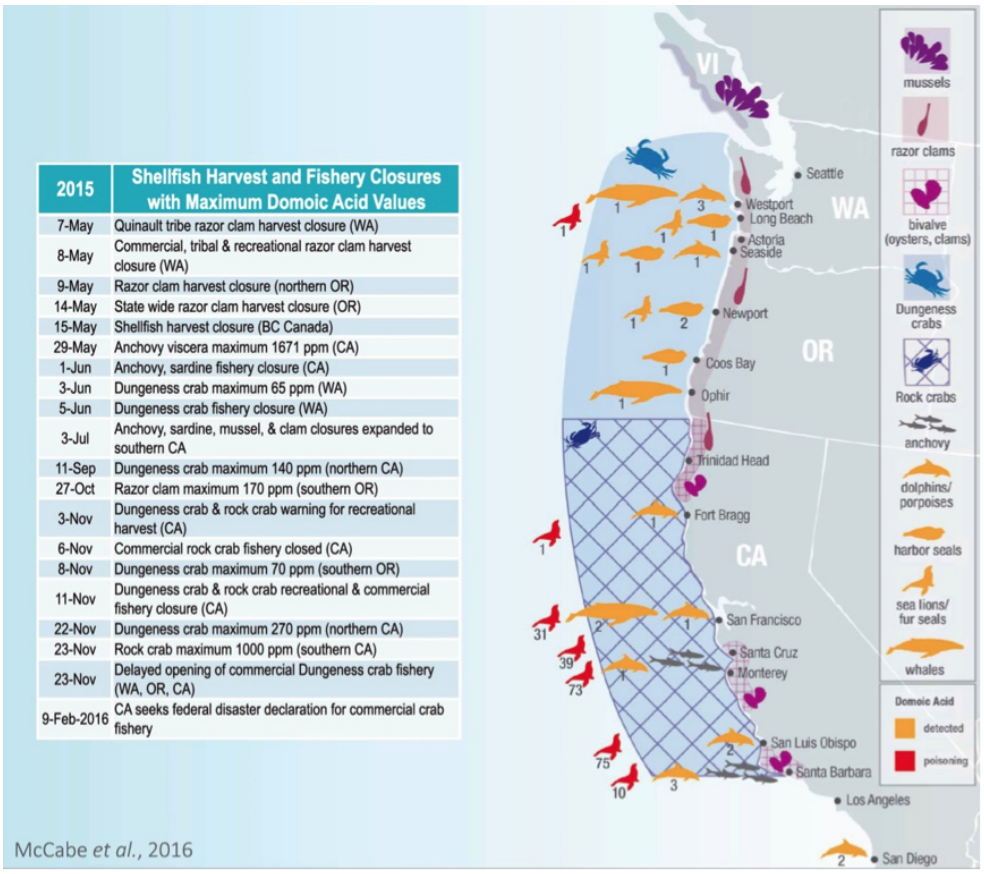

Figure 1. Widespread impacts of the 2015 HAB on U.S. West Coast fisheries and marine mammals. Shaded regions represent offshore and inshore closures of economically important shellfish. Northern anchovy closures are shown at landing sites off California with fish symbols. Stranded marine mammals with domoic acid detected and/or poisoned are shown by respective animal symbol, with the number of impacted individuals reported. A timeline of impacts on shellfish harvests and fishery closures is shown in the table with maximum detected concentrations of a harmful algal neurotoxin, domoic acid. [Open-access figure originally published in Geophysical Research Letters[2] with permission to reprint from R.M. McCabe.]

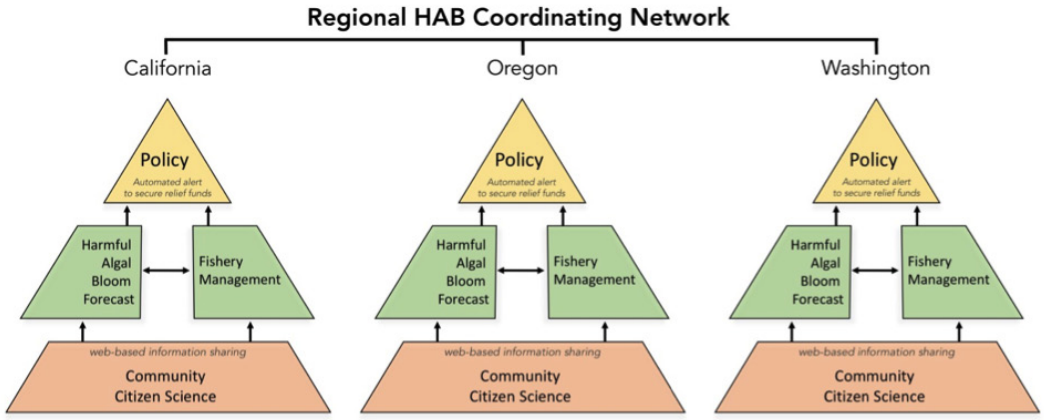

Figure 2. Framework for disseminating HAB knowledge between communities, science institutions, fishery managers and policy makers at the state-level under a tri-state HAB network coordinated by state policy and fishery management leaders in California, Oregon and Washington. Arrows represent pathways of information sharing between state-level sectors.

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1st Runner-up

Stricter Emissions Controls to Preserve Australia's Ecologic, Environmental, and Economic Stability

Yale-NUS College
Stephanie Chee

The Pacific Ocean, being the largest and deepest of Earth's oceans, influences a vast number of islands and nations and sustains abundant marine ecologies. Climate change and the rise of global temperatures affects the Pacific Ocean in many ways. With higher surface temperatures, thermal expansion of the sea and melting of ice sheets cause sea-levels to rise. Sea-level rise increases coastal flooding events, and can completely inundate low-lying island nations and coral atolls, forcing citizens on the islands to relocate (Guzman, 2013). Rising ocean temperatures also acidifies oceans, which damages coral reefs. Thermal stress can cause coral bleaching, and ocean acidification slows down coral regeneration (Great Barrier Reef Marine Park Authority). The world's largest coral reef system with outstanding biodiversity lies in the Great Barrier Reef off the coast of Queensland. Australia thus has a moral responsibility to protect the reef which is home to ecosystems with diverse species. While Australia's coastal regions are directly affected by sea-level rise, Australia will also be indirectly affected by climate refugees from other island nations. With considerable similarities to small island nations, nations like the Maldives and Tuvalu are considering an exodus to Australia when oceans levels become too high (Guzman, 2013). An influx of refugees could trigger conflict and disorder in Australia. To protect the marine ecology and to preserve stability, Australia must include larger-scale action plans in its Reef 2050 Plan and contribute to slowing sea-level rise by making emissions reductions mandatory.

The ministry should include in the Reef 2050 action plans mitigation efforts against larger-scale climate change effects such as ocean heating and acidification, as well as plans to form alliances with other Pacific island nations to protect the ocean cooperatively.

While the Reef 2050 Plan indicates actions to protect the Great Barrier Reef and its ecosystems, it does not consider the reef in its broader relation to the Pacific Ocean. Non-localized impacts such as changes in the Pacific Ocean's temperature and acidity affects the entire oceanic system. To protect the Great Barrier Reef and its diverse marine ecology and to maintain the reef as a source of tourist revenue, significantly more regional efforts are needed. This effort entails a larger contribution to international emissions reductions. With Australia having the 16th highest per capita emissions in the world in 2013, the ministry needs to implement more stringent carbon restrictions (see next recommendation) to help slow sea-level rise – both for the sake of small island nations and Australia's border security – and to protect Australia's valued reefs. The way neighbouring nations interact with the ocean is also important as activity in different Pacific regions are interconnected by the ocean. To ensure a shared commitment towards

maintaining the health of the Pacific Ocean, the ministry should reach out to neighbouring Pacific Island nations to construct a cooperation agreement. The agreement should include guidelines on how to manage the coast and on what and how much substances can be released into the ocean. A penalty should be decided for countries/islands who breach the agreement.

On top of the Emissions Reductions Fund (ERF) scheme, the ministry should instate a policy for mandatory emissions reductions of a decided percentage per year, applied to all major industrial emitters. This is necessary for reaching Australia's Paris targets.

The repeal of Australia's carbon tax has led to a 4.3% increase in carbon emissions, undoing part of an 11% fall in emissions during the two years the tax was in place (Australian Associated Press, 2015). Furthermore, Australia's current climate policies are insufficient to reach her Paris Agreement targets of 26 – 28% emissions reductions below 2005 levels by 2030 (Climate Action Tracker, 2016). A limitation of the current ERF is that it poorly engages the big industrial emitters (Slezak, 2016). To effectively target these major emitters, the ministry should introduce a mandatory emissions reductions policy that is penalty-based rather than incentivization-based. Industries will be required to submit their emissions analysis at the end of every year, and those who fail to meet the reductions requirements will pay a fine that will be invested in Australia's renewable energy sector. The policy would produce a secondary benefit of increasing overall investments in energy efficiency and renewable energy technologies. The government must remain steadfast in the face of opposition from industry, framing the policy as an overall cost-saving scheme for the industry.

The recommended policies will help preserve the health and vibrancy of the Great Barrier Reef and maintain peace and security for Australia's future, while bringing economic benefits through tourism revenue and saved costs from industries' mandatory investments in cleaner technologies.

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2nd Runner-up

Creating Consumer Awareness and Accreditation for Coral Triangle Fisheries

National University of Singapore
Nicole Lim

Summary: This policy brief serves to propose a demand -side solution to address the threat climate change has on the fisheries in the Coral Triangle – a region located in the Asia Pacific and scientifically declared to be "the global centre of marine biodiversity"[i]. Addressed to the Coral Triangle Initiative (CTI) Executive Secretariat, a multilateral and multi -stakeholder partnership, this brief identifies the lack of international recognition on the global relevance of the Triangle; proposes for the inclusive of the creation of consumer awareness as part of planned initiatives to increase the CTI's profile; and lastly a suggestion for the Secretariat to develop an accreditation scheme to better trace and inform consumers of unsustainable fishing practices within the Coral Triangle.

1. The lack of an international recognition on the significance of the CTI.

A simple Google Trends search revealed the lack of recognition on the Coral Triangle region, as compared to the Great Barrier Reef (Appendix A). This is particularly concerning as three o ut of six Coral Triangle Countries are included in the top 25 marine capture producers[ii]. As stated by Executive Director Mr Widi in the 2015-2016 CTI Annual Activities Reportiii, raising the profile of the Coral Triangle as a region of high biological significance is crucial. Marine biodiversity and productive fish stocks in this region are coupled and will both be severely affected by climate change and its consequences. As marine capture is an internationally traded commodity, and one of the CTI's main focus is the sustainability of its fisheries, it only makes sense for this multilateral Initiative to devise policies which will enhance the traceability of marine capture. This is such that consumers and the wider international community are made aware of the presence of unsustainable practices that are threatening to worsen climate change impacts on the biodiversity and productivity of the Coral Triangle.

2. Aligning academia, science and consumer knowledge on impact of fisheries in the biodiverse Coral Triangle.

While illegal and unsustainable fishing within this region are common news and academic topics[iv, v,vi,vii,] there is an absence of its correlation to the ecological and social significance, sensitivity and the compounding impacts of climate change on the Coral Triangle . As such, policy for increase the profile of this region should include focus on changing marine produce consumer awareness on their purchasing choices. It is estimated that the global cost of illegal fishing is up to $10 -23.5 billion a year[viii]. Therefore, in diverting consumer purchasing power to more ecologically sound and managed fishing methods, there will be an increased chance of preserving the ecological integrity of the Coral Triangle in light of climate change.

As of now, engagement is very much focused on the political and social sphere while economics and private sector interests are less targeted. While it is crucial to ensure that the sup ply end of fisheries are managed (through existing initiatives such as streamlining of export regulations)[ix], policies on demand-side solutions should be adopted in complement as well. As such, the CTI Secretariat, along with relevant stakeholders, need to be intentional in their plans to increase the Coral Triangle's international profile, and such efforts should include messaged to raise consumer awareness on the unsustainable origins of their purchases. This could simply take the form of including such messages in handouts, presentations, videos etc. made by the Secretariat.

3. Developing a certification scheme for sustainable fisheries through leveraging on CTI's intergovernmental and multi- stakeholder network.

The CTI Executive Secretariat has successfully established strong partnerships with USAID, the Australian Government, WWF, Conservation International, among others. It has also coordinating monitoring and reporting working groups to obtain ecosystem-wide information on the Coral Triangle. This therefore puts the CTI Executive Secretariat and the CTI countries in an advantageous position to leverage on these partnerships and existing functions to develop an accreditation or certification scheme for marine catch production in the region. Such an accreditation is largely undeveloped in this regionx, despite it being a cooking pot for unsustainable fishing practices[xi]. The Secretariat could choose to adopt existing accreditation systems like the Marine Stewardship Council, or designate a taskforce to consolidate such information and procedures necessary, specific to this region.

Similar to how unsustainable palm oil in Southeast Asia has developed its own international recognition and consumer awareness from the efforts of green groups and certifications like the RSPO, the CTI can leverage on its reach to do the same.

Conclusion

Science has shown that climate change will have severe impacts on marine ecosystems, threatening not just biological diversity and human livelihoo d, but also the ability for such systems to be resilient to changes. As a region troubled with many social and environmental problems, this policy brief has proposed a focused target at the demand -side of unsustainable fishing practices that weakens the resilience of this ecosystem in the face of climate change. It is but one means to address a problem that can affect many.

Appendix A

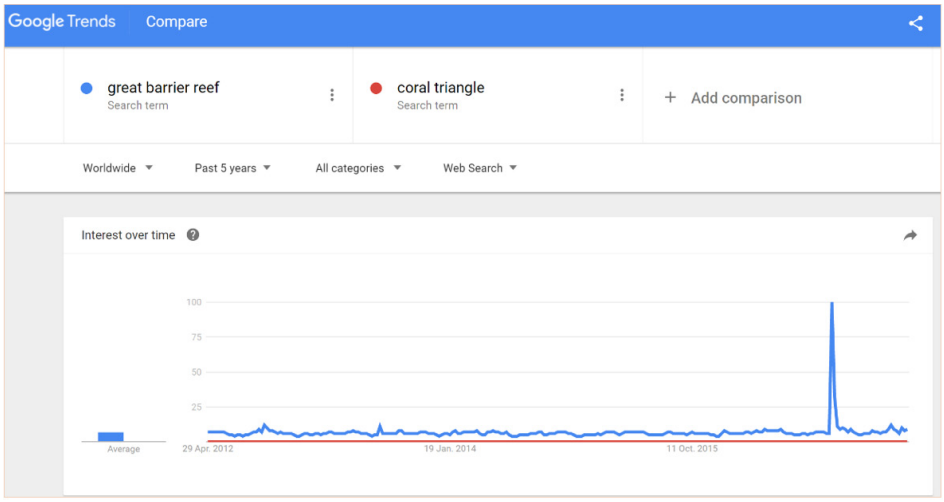

Figure 1 Screenshot taken from Google Trends, 18 April 2017

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Top 10
Case Submissions

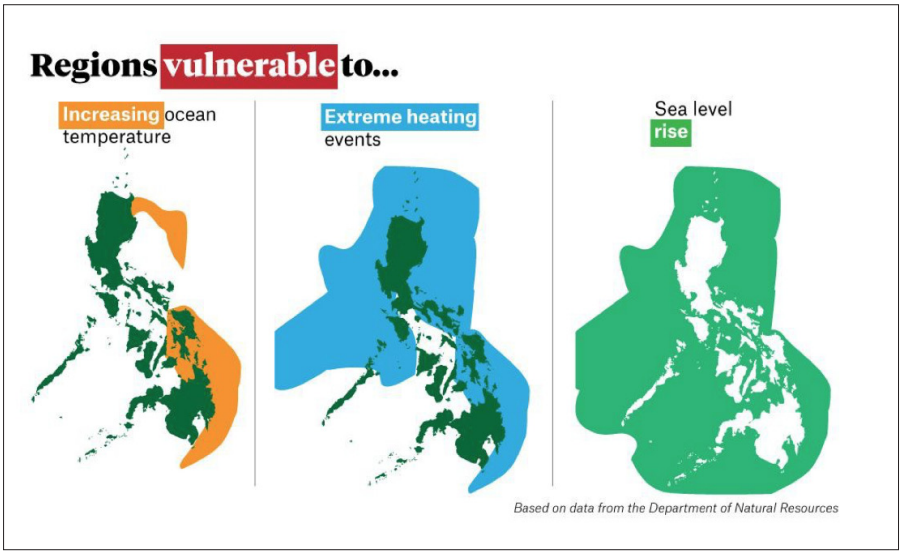
Other Entrants

The Future of the Pacific Ocean

Ateneo de Manila University, University of the Philippine
Carlos Arcenas, Benjo Buensuceso

Executive Summary
Global climate change and the resulting extreme weather events have put the Philippines and its abundant marine resources at severe risk. In response, the nation has committed to promoting climate resilience and emission reduction worldwide through participation in conventions like the Paris Agreement, and has taken steps in crafting mitigation and preparation programs to reduce the impact of worsening climate conditions. In line with this commitment, this brief recommends that the Philippines not only maintain its cooperation with these climate agreements and initiatives, but also spearhead further negotiations and development to protect itself from worsening climate change.

The Problem
Thanks to its geographic location, the Philippines is one of the countries most vulnerable to climate change-related threats. These threats, most prominent of which are extreme weather events, are projected to increase in risk due to a confluence of factors, including rising ocean temperatures and degrading marine ecosystems. In addition, different regions face unique threats based on their natural features, from sea level rise to extreme rainfall.



Regions vulnerable to climate change effects (data from DENR[1])

The present and potential losses from these threats are staggering. A former Climate Change Commission (CCC) Commissioner estimated that typhoons alone cost up to 5% of gross domestic product (GDP) every year.[2] The ecological losses may be worse: approximately 0.6% of the Philippines' coastal area is projected to go underwater because of rising sea levels.3 Marine ecosystems, a key source of livelihood for millions, have progressively worsening conditions because of ocean warming,4 and climate change is projected to double the risk to these by 2100, even assuming ambitious mitigation plans are followed.[5]

In light of these events, the national response to disaster is also under scrutiny. The government recently shifted its focus from disaster relief and response to DRRM at both the national and local level, with mixed results5. Numerous problems have been found with the implementation of this framework, most significantly the prevalence of patronage at local government units (LGUs), all which have contributed to significant underinvestment in DRRM programs[6].

Key Parameters
Climate scientists have established a direct relationship between increasing emissions and global warming6 resulting in rapidly changing climate conditions. Oceans have acted as a powerful climate regulator, having absorbed 93% of excess heat from human-caused warming[7], at the cost of possibly irreversible biogeochemical changes.

In light of this, last 2015, 195 countries, including the Philippines, agreed to the Paris Agreement to immediately begin addressing these problems.[8] It emphasizes emissions reductions and financial support for more vulnerable nations. Notably, it was the first international climate agreement to officially recognize the importance of oceans.

The Philippines pledged to reduce its projected emissions by 70% in 2030. This would require large-scale changes in the country's energy supply, leading the Department of Energy (DOE) to outline a National Renewable Energy Program (NREP) to meet both emissions and energy capacity targets[9]. This is in line with initiatives headed by the CCC, which coordinates climate change projects on the national level. These are then implemented locally by LGUs and in coordination with the National Disaster Risk Reduction and Management Council (NDRRMC). The Green Climate Fund, developed in past climate agreements, is meant to help vulnerable countries like the Philippines finance these measures, but only a fraction of the desired fund of $100B has been raised.[10]

Policy Recommendations

Due to the sheer urgency of the climate crisis, the Philippines should immediately comply with the Paris Agreement—especially considering how the future costs of climate change dwarf the expected present costs for mitigation and adaptation.[11] The rich marine resources of the country could also be leveraged more by the Department of Environment and Natural Resources to find climate-resilient ecosystems that can be used as blueprints for other ecosystems around the world.

On the national end, to attain its emissions targets without sacrificing energy security, the NREP should be followed, partially funded by the GCF. This requires significant investments by the DOE in increasing energy efficiency and a shift away from fossil fuels, such as a moratorium on the opening of new coal power plants[12]. A more robust monitoring and feedback system for DRRM by the NDRRMC should also be established to ensure adequate LGU capacity to respond to extreme weather and prevent non policy-oriented decision-making.

However, the Philippines cannot act alone in curbing the worst of climate change. The targets set in the Paris agreement may not be enough to reach the goal of limiting temperature rise to 2º C13. As one of the most vulnerable nations, with vast land and sea resources at stake, the Philippines must take a greater role in calling for more significant, legally-binding emission reductions worldwide, alongside stronger compensation and climate adaptation financing mechanisms to help all nations, especially at-risk developing economies, achieve this goal.

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Australia's Wake-Up Call for The Reef's Policies

Hong Kong University of Science and Technology
Felicia Rebecca Isjwara, Joo Eun Kim

Statement of Issue

The Pacific Ocean—the largest body of ocean on Earth—is going through a variety of transformations, mainly as a result of climate change. Climate change impacts have started to upturn the fundamental balance of the natural ocean. One of the major areas is Australia's Great Barrier Reef.

The Great Barrier Reef (GBR or the Reef) in Australia is a UNESCO World Heritage Site but is unfortunately experiencing damage that threatens its very existence. Rising sea temperatures cause coral reefs' source of energy, the algae, to leave, killing them in the process and turning them white. This stress response is called coral bleaching, and is a major concern for the Reef's lifespan. Furthermore, other aspects of climate change such as ocean acidification are damaging the Reef.

The Australian government is aware of this and has taken several approaches to preserve the Reef, including the infamous Reef 2050 plan and the coral bleaching response plan (now the risk and impact assessment plan) created by The Great Barrier Reef Marine Park Authority (GBRMPA). However, initiatives that have a more direct impact to the Reef with minimal disruption to the surrounding economical activities are needed.

Policy Options

- **Option 1:** Regulate coal mine plants in order to shift Australia towards renewable energy. For example, an immediate action that can be taken would be to prevent the Carmichael coal mine (and other coal mines) from being built despite their claims of harvesting "clean" coal.
  - **Advantages:** Prevent what can be a huge threat to the Reef, especially with the emissions from the mine that is located near the Reef. Exporting the coals would also require shipping that passes through the Reef.
  - **Disadvantages:** Australia is the largest exporter of thermal coal and that could have implications to the economy; the coal mines provide jobs (the Carmichael coal mine is expected to create jobs for a depressed region in Queensland).

- **Option 2:** Build reef resilience through coastal development and management of water quality. Manage coastal development in order to protect the local biodiversity. Improve quality of water that is flowing to the Reef by passing on regulations that reduce chemical and sediment pollution to the Reef from farms.
  - **Advantages:** Stricter regulations can control usage of pollutants such as fertilizers and minimize runoff into the ocean. This is important as the water quality is very important for reefs to grow and thrive. Reefs grow best in waters where there are low concentrations of sediments.

% Disadvantages: Control is difficult, and there will be time and effort needed to influence a significant change. Farmers may also disagree or be unwilling to cooperate with certain regulations.

- **Option 3:** Getting active support from the Government and large environmental organizations to work on "blue carbon" initiatives. Enhancing and preserving marine plant environments near coral beds to uptake carbon dioxide and help to offset some of the ocean acidification impacts in the long-run.
  - **Advantages:** Similarly to plants on land, marine plants have the ability to store and lock in carbon for a long period of time, reducing the amount in the ocean.
  - **Disadvantages:** The damage of such environments can release even more carbon dioxide into the water and must be dealt with carefully.

- **Option 4:** Education and communication. Reaching out to important stakeholders such as the general public about how human activity is negatively impacting the health of the Reef, and what they can do to help.
  - **Advantages:** Education is a long-term investment that can help to respond to the root cause of climate change. With collective country-wide efforts, positive impacts may be seen.
  - **Disadvantages:** Reach is not guaranteed, and so is action. Such action must also be taken on a very large scale to have a seeable impact.

Policy Recommendation

The situation of the Great Barrier Reef evidently and urgently calls for solutions to deal with unfavorable effects from climate change to ensure the long-term health of the Reef, which is a major part of the Pacific Ocean. We recommend a top-down approach from the government and other large environmental organizations to introduce blue carbon initiatives to the public. National approaches to blue carbon have been done previously in Indonesia, the Philippines, Ecuador, and Costa Rica. We believe that it is in the best interest of the Reef for the authorities in Australia to follow suit. The effort would require collaboration on the central- and district-level authorities. The direct effect of putting the blue carbon initiatives in place is the lowering of greenhouse gas emissions and concentration of carbon dioxide in the ocean, which would lead to lower temperatures around the coastal area and an improved environment for the Reef.

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The Future of the Pacific Ocean

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To Prime Minister English,
The adverse effects of climate change will have pronounced effects across all the Pacific region. As Prime Minister, you have the leadership position to enact change that will benefit future generations of Kiwis. While famous for mountains and glacial lakes, our beautiful country is also responsible for low lying pacific islands with a great plethora of kaimoana. Known for your adoption of big data and fiscal conservatism in policymaking, this report will use economic data when discussing climate change and the Pacific Ocean before giving policy suggestions at the end.

What's to blame?
Known as 'anthropogenic climate change,' human activity has produced an overload of green house gasses to what the planet naturally can handle. These gasses, such as carbon dioxide, have been produced in surplus to what the Pacific Ocean is naturally able to absorb, thus it has begun to warm. The warming has begun to melt polar ice and change the regions' weather patterns.

Two harbingers
Heralding the Pacific Ocean's change is The Blob in the Pacific's north east. This 1600km^2 patch of slow moving warmer water is 2.5‰warmer than surrounding areas and appeared in 2013. Scientists agree that the warming pacific is creating more extreme weather events. For example, Northland has had drought six times in nine years- the worst in 2013 costing New Zealand 0.7% of GDP. As the ocean warms, freak weather events are becoming more common, just last year there was a hail storm in Samoa. The recent cyclone, Debbie, in Queensland shows that while the number of cyclones a year is dwindling, they are getting stronger.

Acidification of the Pacific is also a threat. Dr McGraw at Otago University says that the change in acidification of the pH level, through the increasing amount of carbon dioxide releasing hydrogen ions in the water, affects shellfish in two ways: through removing carbon ions in the ocean water which they build their shells with, and reducing habitat due to algae die-off. Oregon experienced major die-offs starting in 2005 with some facilities' production dropping by 60%. In 2015 NZ aquaculture was a $500m revenue industry. Mussels which made up 73% of the value of exports, have declining grip strength as acidification occurs meaning they cannot be farmed.

And in the long haul?
Somewhere between a two and three metre rise before the end of the century is predicted. Rising sea levels will submerge low lying areas of our cities such as Britomart, Rongotai, and Redcliffs. Communities on the East Coast such as Tologa Bay, will need to relocate to higher ground. Citizens of dependencies such as Tokelau and Niue, which their people have made home for a literal millennium, will become climate refugees as their islands shrink. The highest point in Tokelau is only five metres above sea level. The geography of New Zealand and the Pacific will change.

A change in coastal upwelling will bring increasing nutrients from the depths of places like the Kaikoura trench into the coast. The surplus of nutrients will cause the algae to 'bloom' which destroys animals' habitats. One of the animals affected will be Zooplankton, as their population dwindles it will cause a negative population shock up the food chain as they are on the bottom rung.

From a financial standpoint, doing something about it now saves money in the long run. However, to some communities in New Zealand the cost of a changing Pacific Ocean will destroy livelihoods and ways of life that are not measurable by a dollar figure.

The fourth-quarter comeback
Our policy response should be divided between two sections: preventing future climate change, and preparing for the worst. We are at the mercy of larger carbon producers like China and the US, so we must use our international standing to get them to improve their reduction commitments. While New Zealand's carbon emissions are less than 1% of the US', we should still do our bit in reducing our emissions because to do otherwise would be hypocritical and would diminish our reputation.

- **Domestic:**
  - Land reclamation through building of infrastructure such as sea walls and artificial islands, these could be built by people who lose their jobs as a result of the effects of climate change.
  - Reform the aquacultural industry by genetically engineering aquaculture species so they can resist forms of oceanic change, or introducing government grants to move aquaculture inland into controlled temperature pools.

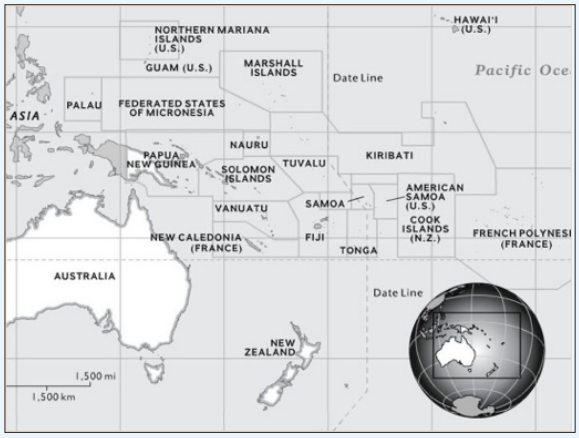
- **International:**
  - Use NZ's leadership in international organisations such as the PI Forum and UN to broker deals between the major Pacific nations. For example, only allow movement of military assets through PI Forum waters if that nation has met the Paris Agreement targets.
  - Start to resettle climate refugees in New Zealand to avoid a mass refugee issue in the future.

Future Proofing Pacific Nations for Climate Change Effects
A Policy Brief on Climate Change Migrations for Oceania

University of Auckland
David Lloyd Hare

Key facts

- Oceania is made up of 14 independent nations.
- Excluding Australia, New Zealand and Papua New Guinea, Oceania's population accounts for over 3.2m people living on 90,000 sqkms of land.[1]
- 23% of Oceania's population live in LECZs (low elevation coastal zones), 12% of the total land. This equates to an at-risk of 600,000 people. A handful of nations have a 40–100% LECZs.[1]
- Coral reefs support 25% of all marine life, though they constitute only 0.1% of the ocean floor.[2]
- Coral bleaching points to how the oceans have absorbed 93% of global warming heat of the past 50 years.[2]



Oceania – source: National Geographic.[3]

Executive summary

To avoid urgent humanitarian crises, or situations of profound emergency and loss of life involving many thousands of people, a pre-emptive international policy of assistance is needed. Policy is required to enable island nations and their larger neighbours to successfully mitigate the management concerns of any inevitable climate change migrations and their associated disruptions to social, cultural and economic status.

Storm induced infrastructure destruction, lack of access to clean water, marine environment degradation – resulting in food insecurity, cultural and economic hardship – are more eminent concerns than rising sea levels.

Context

Oceania is made up of 14 nations and covers a large portion of the South Pacific. The political stability of many of these nations face significant threats due to the socio-economic disruption. This will be caused by denigrated habitable and arable land areas, diminishing freshwater supply and marine environment destruction. This will lead to mass, forced migration events. Multi-lateral policies and agreements are needed to address this. The policies required of global economic powers, include:

- Leadership
- Provision
- Management
- Ongoing support

Alternatively, the difficult task, with all its associated costs, of the sudden need to resettle large numbers of climate change migrants will be incumbent on Oceania's neighbours, their economies and their societies.

Climate change effects are inevitable

Proven scientific modelling and empirical evidence has shown the continued likelihood of the past three years' (2014-2017) record high temperatures will likely continue, resulting in the new norm of intensified cyclonic activity, rising sea levels and the destruction of marine environments and their associated fisheries. Earlier reports (Schwartz 2015) of El Nino conditions becoming more common have been further substantiated in the latest reports. They show consistently higher temperatures and continued storm and environment damage occurring throughout the past three years. The likelihood of this abating is low, such that the effects on Oceania can no longer be ignored.[4]

Island nations face four unavoidable issues

Of all the issues faced by Island nations, these four are the most urgent:

1) The loss of habitable urban centres due to their low-lying proximity to the sea.
2) The loss of arable land due to both rising sea levels and the new-norm of voracious, powerful cyclones.
3) The loss of culturally important coral reef marine environments, upon which island nations depend for both food and tourism.
4) Changing weather patterns and rising sea levels will cause drought and

reduce access to potable water in many of the Oceania nations.

Mitigating these effects requires more than just aid package policies

1) Some of these climate change effects may not be mitigated by humanitarian aid packages. Instead, the possibility exists that nations may need to abandon their countries altogether.
2) Migration polices are the primary barriers to island nations.
3) Island cultures have a deep-seated connection to their land. Preemption of the need to assist cultures to relocate and integrate with other cultures before time runs out is paramount.

American Samoa:
After repeated bleaching, the coral dies.[2]

Leaving Oceania to deal with climate migration by itself does not bode well for any UN member state, if it is left to the last minute to solve.

Give people the time and resources they need to act by themselves

Given enough time and resource, people are industrious enough in themselves to adapt and adjust to the climate induced disruptions and the associated socio- economic impacts that are predicted for the near future. The political policies of more substantial nations should be considered to help Oceana face the coming trials of climate change.

Policy critique

1) Leadership is needed to form policy that leverages the funds and expertise from organisations set up under the United Nations – like the Adaption Fund – to include assisted migration and resettlement programmes.
2) Governments and their societies, engaged in facilitating the reception of climate change migrants must be provided with economic and political provision, to ensure humanitarian programmes embrace both cultural competency as well as relevant socio-economic enlargement.
3) Receiving nations will need to develop new immigration policy to manage the non-urgent accommodation of an estimated 600,000 climate refugees. Both sending states and receiving states need the full weight of international agreement to facilitate and safeguard sovereign states' existing communities and their rights.
4) Policies for the ongoing management of integrating affected communities and the associated potential issues this may cause within host nations, will need to continue from within a multi-lateral concern.

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The Future of the Pacific Ocean

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Summary of the Problem

Schwartz's "The Pacific Ocean Becomes a Cauldron" explains the variety and severity of changes occurring in the Pacific Ocean. Schwartz says the Pacific Ocean is "causing problems for people and marine life across the Pacific Rim and beyond" (Schwartz). Though issues like an increase in severe storms and an increase in nuisance flooding are relevant, this brief will focus on the Harmful Algal Bloom (HAB) affecting the Western seaboard of the U.S. This HAB has "rendered shellfish toxic and shut down shellfish fisheries in Washington, Oregon and California", causing huge economic losses (Schwartz). This massive HAB is linked to an "unusually persistent zone of warm water that has been sitting off the North American coast [...] called 'the Blob'" (Schwartz). This nutrient-depleted warm water is also linked with significantly higher species die-offs, but it best serves as a "wake-up call" for the "the consequence[s] of messing around with the climate", as this warm water could very well represent the future of the Pacific Ocean (Schwartz).

Responsibility for a Solution

This policy brief is directed towards current governor of California, Edmund Brown, and California Secretary for Natural Resources, John Laird. These leaders can demonstrate to the state senate that this proposed solution to the Blob is in line with Gov. Brown's mandate that all California infrastructure proposals take into account climate change (Executive Order B-30-15). The steps suggested in this brief fall within the jurisdiction of the California Natural Resources Agency, specifically that of the Department of Fish and Wildlife's mandate of "ecosystem conservation and restoration" (Infrastructure Plan, 31).

General Solution

An effective solution to this issue must respond to the underlying cause of the HAB. With this in mind, I propose an action plan centered on implementing offshore upwelling along the Northern California coast, between the 42° and 39° latitudes. This solution revolves around creating offshore upwelling between these latitudes through the use of "spar-buoy wind turbines" (Viudez, 1). This artificial upwelling would bring cold, nutrient-rich deep water up to the surface, simultaneously cooling The Blob through the principle of thermal equilibrium, and releasing unused nutrients into excellent fishery waters. As the artificial upwelling proposal rests on using technology that has yet to be fully developed and implemented on a large scale, the most prudent course of action would be to address the HAB through a trial period of competing artificial upwelling systems. The length and nature of the period from trial to full-scale implementation should be handled in a more focused proposal to be issued upon adoption of this plan.

Nature and Feasibility of this Solution

Though the design of these turbines will change along the course of the of this project, the current model envisioned by Viudez et al should serve as a starting point. The benefits of this design are its self-sufficiency and ability to upwell large amounts of water (Viudez, 237). The proposed area is an ideal location for this type of installation because the average offshore wind speed in this region is 21.3-23.5 mph, a prime source of energy (Wind Maps). Also, this region is right in the path of the North Pacific, Alaska and California currents. This would facilitate the spread of the upwelled water along the entire Western seaboard, simultaneously cooling Blob as well as moderating nutrient dissemination along the coast, thus limiting the potential for extreme marine population booms, a key concern cited in Viudez et al (244).

Costs and Benefits

In 2016, the Levelized Cost of Electricity for offshore wind dropped to a low of $126/megawatt-hour (Offshore Wind). This cost will serve as a benchmark for the introduction of spar-buoy turbines similar to those detailed in Viudez et al, and should provide an accurate representation of the lifetime costs of each turbine. However, as this proposal calls for the development of new hardware, initial costs would be higher than current offshore turbines. Despite this, from 2000 onwards, California fisheries have been worth an average of $150 million a year (Fishery Activity), and have consistently created 100,000s of jobs while adding millions in value to the California economy (Fisheries Economics). It is currently impossible to quantify exactly how much value this upwelling would add to the California economy, but it would dramatically increase the yield of California fisheries (Artificial Upwelling, 1).

Risk Assessment

The unknown side effects of artificial upwelling are the main risk factors of this proposal. Though these risks may be great, it can be mitigated through diligent scientific supervision. Furthermore, the ability to increase the yield of the world's oceans may be one of the most accessible ways to mediate between maintaining healthy global fish stocks and the ever-growing global demand for seafood. This proposal could be a key step in ushering in a new era of socio-economic development that is more compatible with Earth's natural systems, as opposed to the current trend harming said systems in the name of progress.

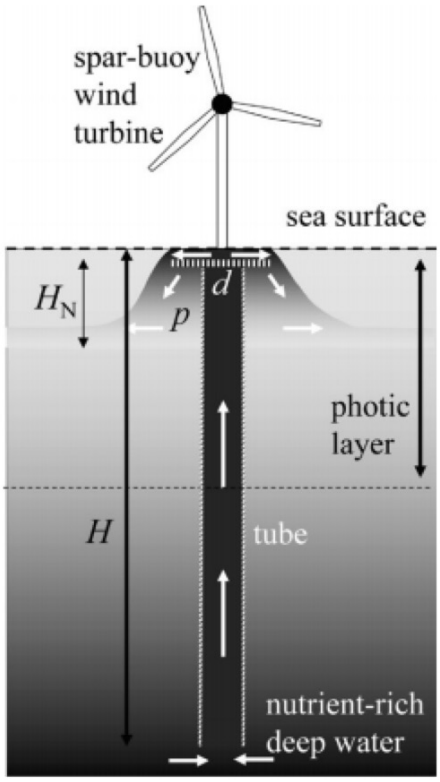
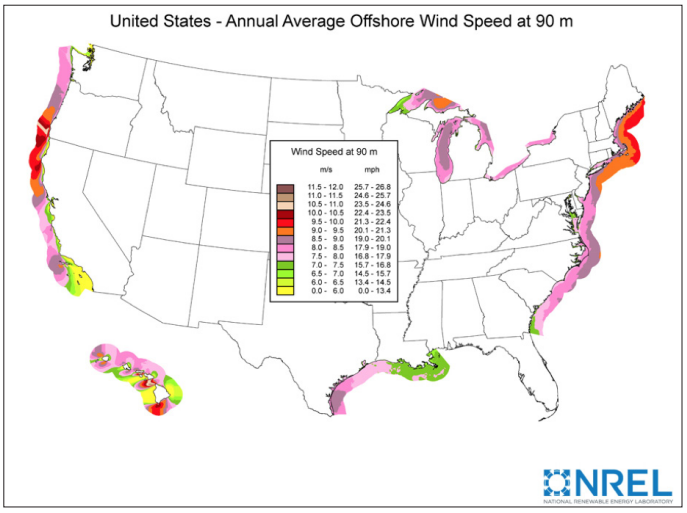


Fig. 1. – Schematic of the spar-buoy turbine upwelling device illustrating its essential (not to scale) parts. Labels indicate the negative buoyant plume (p), the pipe's bottom depth (H), neutral height (H_N), and diffuser platform (d). White arrows indicate water flow and the grey shade qualitatively indicates nutrient concentration.

The Spar-Buoy Turbine envisioned by Viudez et al



Note that the proposed area in Northern California has one of the highest 90-meter wind speeds in the contiguous U.S.

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Impacts of Climate Change on the Pacific Ocean

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Global analyses show the upper Pacific Ocean warming. Sea temperatures on the Great Barrier Reef have increased by about 0.4°C over the past 100 years (Lough, 2000). The Great Barrier Reef is an important Australian landmark. It brought US$4.48 billion to Australian businesses in the 2004/2005 financial year, and resulted in the employment of 63,000 individuals (full-time equivalent). It also plays a critical role in biodiversity.

The GBR is most under threat from rising sea temperatures (resulting in more intense and more frequent coral bleaching events), and ocean acidification (reducing the ability of corals and other organisms to calcify). The 2007 IPCC report on climate change outlines the risks to the Great Barrier Reef and likely outcomes in more detail.

Effects of livestock industry on climate change and the environment

The 2006 report Livestock's Long Shadow by the Food and Agriculture Organization of the United Nations discusses the environmental impact associated with animal agriculture. The livestock industry is responsible for 14.5% of global anthropogenic greenhouse gas emissions. Despite this, there is a disparity in where climate policy focuses. Climate debate and policy rarely acknowledges the role that animal agriculture plays.

Globally, the livestock industry produces around 130 times more waste than the global human population. This waste can contain a host of diseases, and if water ways become contaminated, can be a serious risk for human health. If the waste reaches the ocean, it becomes a source of major environmental degradation. The Australian livestock industry also uses a disproportionate amount of water resources.

Not only does this industry affect wild animals and environment, it also creates an immense amount of suffering for the animals used as food. Many Australians are already against animal abuse. While we tackle the environmental issue, we can also align government policy with the ethical preferences of Australians.

Policy recommendations

A multi-level policy is recommended. We should gradually replace the livestock industry with plant-based farming. This can be done by reducing livestock subsidies and raising a small tax on animal products, creating disincentives for consumers and producers.

We should assist farmers as they shift from livestock to more sustainable produce. The revenue from the animal product tax can be used to facilitate this support, and may come in the form of grants for land use change or subsidies and tax breaks for producing plant-based foods. Arid land in Australia typically used for grazing livestock can be used to grow other foodstuffs such as almonds and dates, or be used for carbon sequestration.

We should support the Australian food tech industry to develop plant-based and cellular agriculture alternatives to animal products. Already we are lagging behind as USA and Europe develops this technology. We should provide the industry with subsidies and research & development credits. We should host international collaborative events to facilitate technology transfer, particularly with USA and Europe, and also aim to encourage new food tech businesses and partnerships in Australia.

We should promote a plant-based, whole foods diet. Whilst also reducing the public-health burden of Australia, this will have the added effect of reducing the consumption of environmentally damaging animal products. This type of public health campaign has already been demonstrated to work through anti-smoking campaigns, and may result in savings based solely on the public health burden reduction.

Australia can become a respected leader in this space whilst much of the world lags behind in action on animal agriculture. Whilst Australia's net emissions are relatively small for the region, our greenhouse gas emissions per capita are amongst the highest in the world. One of our greatest tourist attractions, the Great Barrier Reef, is in danger and relies on a healthy Pacific Ocean.

Australia is also well poised to supply Asia with a range of healthy, environmentally friendly and cruelty-free food. As Asia moves out of poverty and demands more luxury foods, we can provide them with high quality meat alternatives. Vegan Australia is developing a series of recommendations for moving to an animal free agricultural system in Australia, which may be beneficial in formulating our own policy.

This is a multi-disciplinary issue, and it requires multi-disciplinary action. A committee of agriculture reform should be formed to facilitate these changes. The policy recommendations outlined here fall under the portfolios of the Minister for the Environment and Energy, the Minister for Health, the Minister for Agriculture and Water Resources, the

Minister for Trade, Tourism and Investment, and the Minister for Industry, Innovation and Science, and thus each of these ministers' offices should be directly involved.

Through these policy recommendations, Australia stands to benefit financially both in the short and long term, ensure the long term sustainability of our agriculture and tourism industries, and align government policy with public values.

As a consumer of fish in the Pacific Ocean, the Australian pelican is just one animal that will be affected by a changing climate.

Sowing Seeds of Change in the Pacific Caldron

Yale-NUS College
Guadalupe Lazaro, Feroz Khan, Kaushik Swaminathan, Peter Lewis

Singapore's food security is intrinsically tied to the future of the Pacific Ocean, as the nation's heavy dependence on imported food leaves it vulnerable to climate-induced disruptions in the Asia-Pacific food supply chain. Shifting demand and production capacity towards locally- sourced food can help Singapore secure its food supply and prompt a regional shift towards more sustainable food systems in Southeast Asia. Given Singapore's strict land constraints, however, industrial animal agriculture cannot scale to match demand here. Plant-based agricultural technologies, by contrast, can be quickly deployed to provide nourishment scalably and cost- efficiently on the island, supported by existing land-efficient seafood production. We therefore propose a major rethinking of the country's food system through shifting consumption towards local sources, boosting production by investing in agricultural technology and education, and exporting these innovations to strengthen regional food resilience. Such a transition would have significant benefits for both Pacific ecosystems and the climate.

An imperilled Pacific ocean poses an existential threat to import-dependent Singapore, where 95% of food is imported, while Singapore's own food system remains predicated upon unsustainable agricultural practices that endanger ecosystems in the Pacific. Singapore's limited local production is already threatened by climate change; recent warming events and plankton blooms have caused over 500 tons of losses in its coastal fish farms. Similarly, its suppliers in Southeast Asia are threatened by temperature and rainfall changes projected to cause food price increases of up to 84% by 2050. More globally, animal agriculture is both a major emitter of greenhouse gases and cause of dead zones in the ocean, while ecologically degrading trawling to meet fast-growing demand for fish continues to devastate global fisheries. Singapore therefore will confront the effects of an unstable global food system increasingly vulnerable to shocks in the climate and the Pacific. To respond, Singapore must steer its food system towards increased security in the face of climate change while also drastically reducing its ecological impact on the climate and Pacific.

The Singaporean government identifies climate-related food vulnerability as a pressing threat to national security, but has failed to create a self-sustaining and resilient food production system capable of withstanding shocks in the Pacific supply chain. The most immediate policy limitations concern the entrenched export-dependence caused by a lack of secure long-term land leases for farmers, which discourages future investment. Land allocation and resources for agriculture also remain disproportionately geared towards ornamental flowers and aquarium fish, which are lucrative but useless for providing basic nutritional necessities if Singapore's imports are threatened by climate change. Long-term capacity building is similarly insufficient, with strict labour regulations depriving farms of much-needed workers and dearth of agricultural education programs.

Fish farms in Singapore are increasingly threatened by climate change.

First, we recommend two short term policy options. Singapore must begin by increasing its agricultural leasing periods from ten to thirty years in order to give farmers a strong foundation for future investment. Given the labour intensity of farming and its importance for national security, Singapore must also double its foreign worker quota within the sector from one to two foreigners for every local.

In the medium term, Singapore must reform its land use policy. Production of ornamental fish and horticulture currently occupies 63% of Singapore's

agrotechnology park land, and should be entirely replaced with more crops like soybeans, lentils, and vegetables by 2030. Furthermore, the government should steer production away from land-inefficient animal

agriculture towards plant-based foods, which are more land efficient and have a far lower impact on ocean ecosystems. To produce these less profitable but more nutritious and essential crops, farmers should be incentivized through subsidies.

Next, medium term investment in R&D will be critical to mitigate damage to Pacific ecosystems and adapt to forecasted shocks to fish and crop suppliers. Land-efficient recirculating aquaculture systems pioneered by local innovators like Onhand Agrarian and low-carbon hydraulic farming techniques developed by

through tax incentives and public index funds, Singapore can finance a regional transition away from ecologically degrading agriculture. Additionally, the Ministry of Education must mandate a national curriculum that includes food sustainability and supplement this with exchange programs for students and farmers to transplant innovative practices from abroad and start farms locally.

Ultimately, we believe these measures will establish Singapore as a hub for agricultural innovation and enable it to lead ASEAN in a transition towards sustainable food systems. Recognizing the interdependence between the Pacific, climate, and food systems will equip Singapore to enact the ambitious measures necessary to secure its food supply in an increasingly volatile Pacific future.

Sky Greens utilizes a vertical hydraulic rotation system to ensure all crops receive adequate sunlight, drastically increasing yields per unit of land area.

Sky Greens have demonstrated increased yields of seafood and vegetables. As a regional hub for biotechnological research, Singapore is well- positioned to bolster food security in the Pacific caldron by exporting such proprietary technologies to Southeast Asia.

In the long term, Singapore must lead regional capacity building and enter Southeast Asia's food value chain. By investing in food processing, storage and climate-resilient production

Science Under the Sea

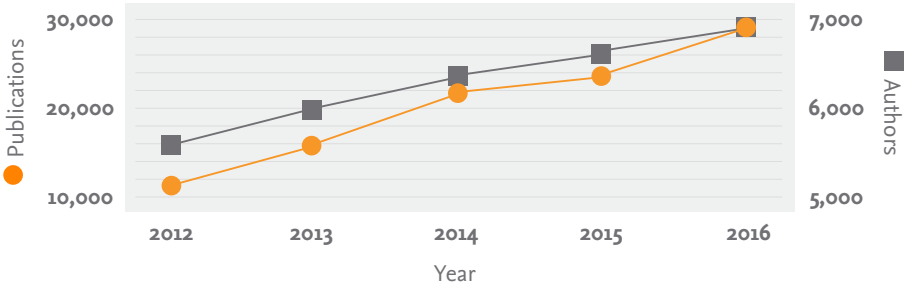
To protect the ocean and marine life, it must be understood

Oceans hold a world of solutions, challenges and opportunities for humans and researchers alike; however, they face drastic changes due to climate change and other threats. Healthy oceans are critical for our future from not only an environmental, but economic and political standpoint.

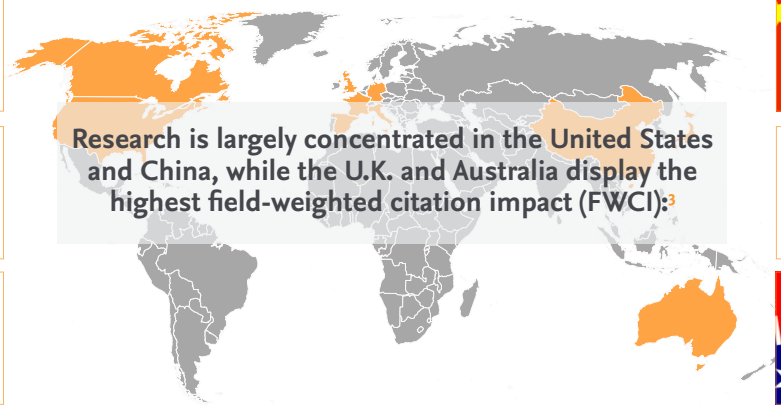
Ocean and Marine Science research is fundamental to understanding both how we can help the ocean and how the ocean can help us. With Scopus® data from 2012-2016, we used SciVal to examine levels of scholarly output, research impact, and trending topics in the global investigation into Ocean and Marine Sciences,[1] with a specific focus on the profound and innovative work being done by the Association of Pacific Rim Universities.[2]

A Global Look at Ocean and Marine Science Research

Research on Ocean and Marine Science worldwide has grown **32.2%** over the past 5 years.



Similarly, the number of global researchers focused on Ocean and Marine Science has increased **61.2%**.



Research is largely concentrated in the United States and China, while the U.K. and Australia display the highest field-weighted citation impact (FWCI):[3]

Canada
#6 Scholarly Output = 1,911
#4 FWCI = 2.13

United States
#1 Scholarly Output = **8,429**
#8 FWCI = **1.8**

Spain
#8 Scholarly Output = 1,632
#6 FWCI = 2.03

United Kingdom
#3 Scholarly Output = 3,194
#1 FWCI = 2.25

Germany
#7 Scholarly Output = 1,876
#3 FWCI = 2.14

Italy
#9 Scholarly Output = 1,336
#7 FWCI = 1.94

China
#2 Scholarly Output = 4,697
#10 FWCI = 0.74

Japan
#10 Scholarly Output = 1,273
#9 FWCI = 1.38

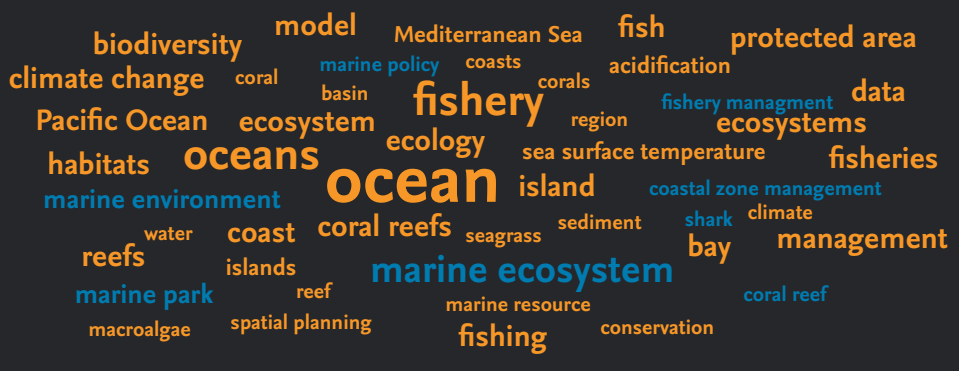
Australia
#4 Scholarly Output = 2,720
#2 FWCI = 2.22

France
#5 Scholarly Output = 2,029
#5 FWCI = 2.06

Trending Topics in Global Ocean and Marine Research

Between 2012 and 2016, within global publications on Ocean and Marine Science, the use of keyphrases such as "climate change" and "biodiversity" have been trending upwards, whereas "marine environment" and "coral reef" have been trending downwards.

Growing
Declining



Ocean and Marine Science Research from APRU Member Institutions

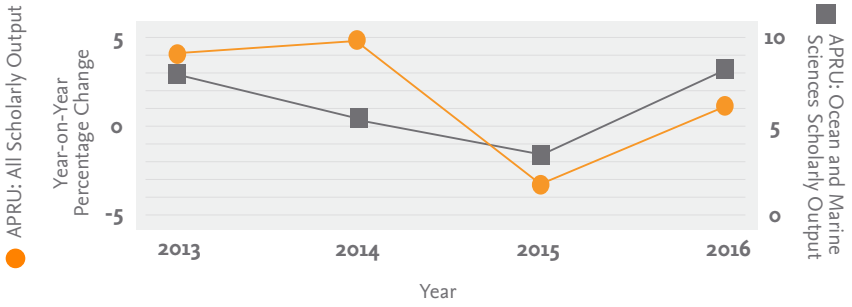
APRU

Founded in 1997, the Association of Pacific Rim Universities (APRU) consists of leading research universities in 17 APEC economies, and joins together 140,000 faculty members and 2 million students.

Scholarly output coming from APRU institutions has grown by

8.2%

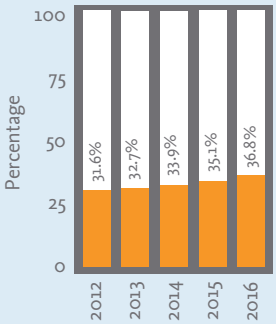
over the past 5 years.



On average, APRU publications on Ocean and Marine Science have a higher FWCI (2.29) compared to their overall average (1.49).

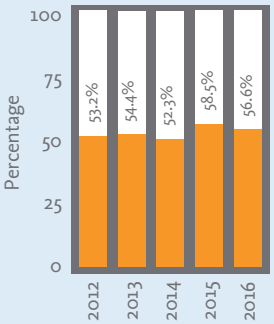
Research Across Borders

Amongst all APRU institutions over the past 5 years, the percent of research from international collaboration increased.



Publications in Top 10 Percentile of Journals (2012-2016)

More than half of publications by APRU institutions on Ocean and Marine Science appear in the top 10 percentile of journals (by CiteScore Percentile).[4]



Top APRU Institutions by Scholarly Output (2012-2016)

All Research

	Publications	Citations	Authors	FWCI
Tsinghua University	62,431	398,446	37,914	1.36
Stanford University	61,974	848,538	33,855	2.53
Zhejiang University	60,522	360,714	53,300	1.12
University of Tokyo	59,087	471,952	31,025	1.36
University of Washington	58,464	720,105	30,341	2.22
Peking University	55,155	449,786	47,386	1.43
University of California at Los Angeles	53,387	666,738	31,184	2.13
University of British Columbia	47,621	507,169	26,400	1.97
University of Sydney	46,749	429,198	20,949	1.86
Seoul National University	46,059	349,433	30,997	1.86

Ocean and Marine Science Research

	Publications	Citations	Authors	FWCI
University of Washington	413	5,385	448	2.77
University of Hawaii at Manoa	393	4,967	455	2.34
University of British Columbia	377	5,981	336	2.85
University of California at San Diego	329	4,844	370	2.53
University of California at Santa Barbara	239	4,936	244	3.16
University of Tokyo	230	1,474	333	1.46
University of California at Davis	224	3,472	263	2.53
University of Auckland	133	1,793	119	2.28
University of Southern California	118	2,209	116	2.71
Australian National University	111	1,403	131	2.99

For further information about Elsevier's Research Solutions please visit: www.elsevier.com/research-intelligence

All data taken from SciVal – 25 May 2017 (Scopus® data up to 4 May 2017) and includes all publication types (articles, papers, surveys, reviews, editorials, etc.)

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Scopus® is the world's leading abstract and citation database, and is used by institutions, governments, as well as for university rankings around the world. For more information, visit Scopus.com.

[1] Defined in Scopus and SciVal as: (ocean or marine) and (science or ecology or policy or economics)

[2] https://apru.org/

[3] FWCI is a measure that normalizes for differences in citation activity by subject field, article type, and publication year. With a world average of FWCI = 1, articles with a FWCI of 1.8 are cited 80% more than the world average.

[4] To learn more about CiteScore, visit https://journalmetrics.scopus.com/

2017

The APRU and The New York Times Asia-Pacific Case Competition

Thank You

We would like to give a special thanks to all the university staff and faculty, students and judges who took part in this year's competition. Without your great support, the competition would not have been such a success.

The judges:

Professor Cindy Fan
Vice Provost for International Studies and Global Engagement, University of California, Los Angeles

Professor Gretchen Kalonji
Dean, Institute for Disaster Management and Reconstruction, Sichuan University

Sarah Anderson
Senior Staff Editor, The New York Times

Dean Napolitano
Freelance Journalist, The New York Times

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Case Competition Task

You are a policy adviser - (s)he may be at national or city level - to a respected political leader who can influence public opinion and change policy. In 800 words, provide her/him with a policy brief on climate change and the future of the Pacific Ocean, which will be the 'wake-up call' described in the article. Include specific recommendations for your geographical location, supported by evidence, on what should be done and by whom.

Judging Criteria

Accuracy (20%)

1 Demonstration of knowledge of the subject matter in discussion, and coherence of the argument.

2 The use of accurate information or data to support arguments, with proper citation and definition of major terms.

Relevance (30%)

1 Appropriate use of theories, concepts, or external data to justify the arguments.

2 The proposal of practical and feasible solution or action with proper justification on the costs or tradeoffs involved.

3 Evidence on relevance or applicability of external data, field data, foreign research or method to the local environment.

Clarity (20%)

1 Well-defined problem followed by a structured and organized presentation of data, ideas, and solutions.

2 Writing with clarity, style and professionalism, free of grammatical and spelling mistakes.

Originality (30%)

1 The proposal of original and innovative solution adequately addressing the case prompt.

2 Demonstration of independent thoughts and critical reflection on the specific circumstances of the situation involved.

3 Directness and magnitude of the impact created by the solution. (Who will benefit and how many of them? What could be the costs and benefits?)

Note: All essays appear in their original form and have not been reviewed for grammatical or typographical errors.

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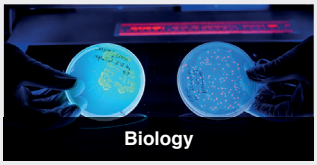

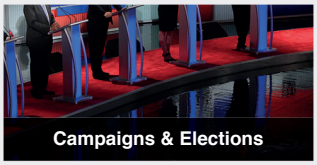

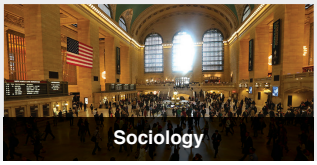

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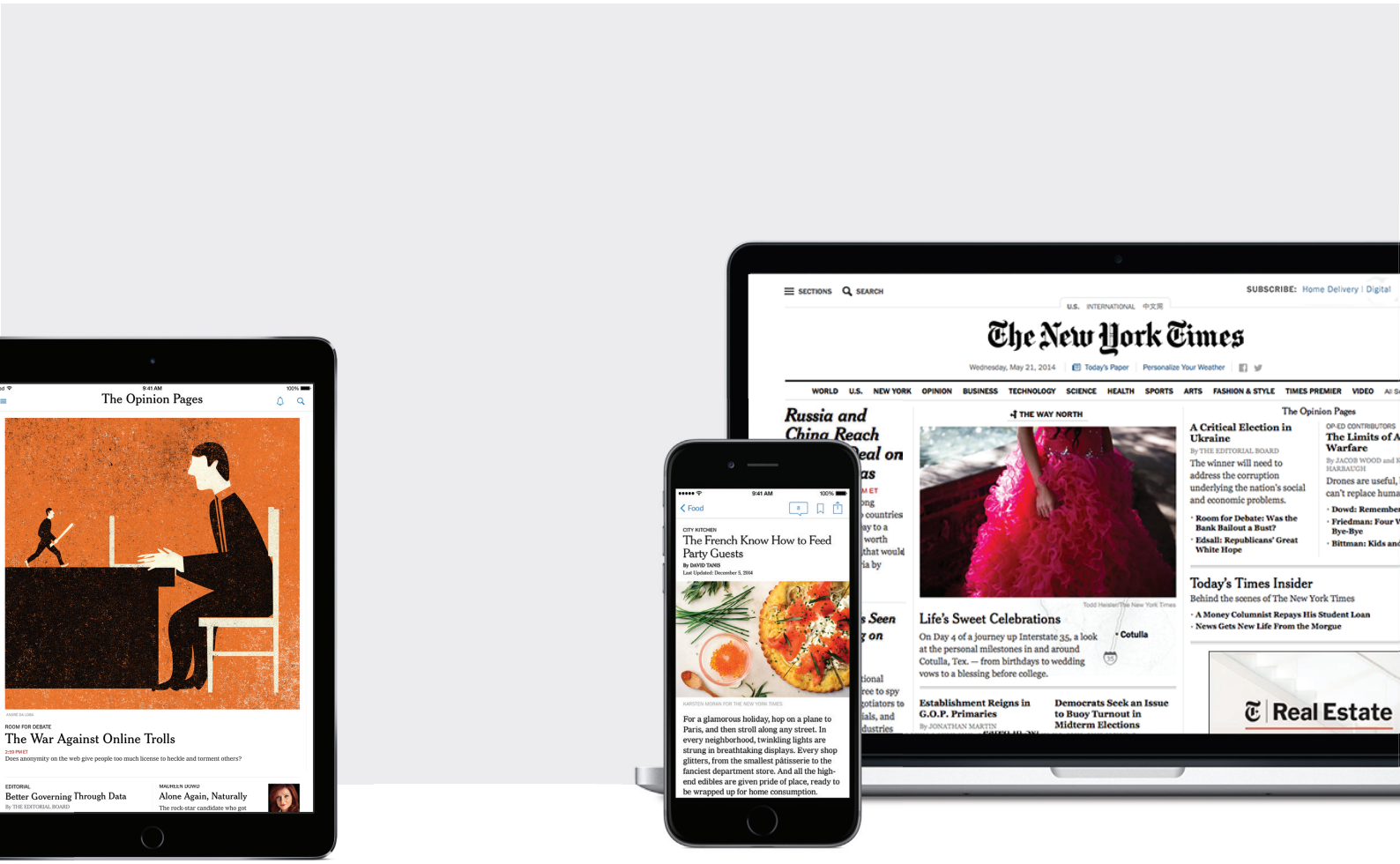

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