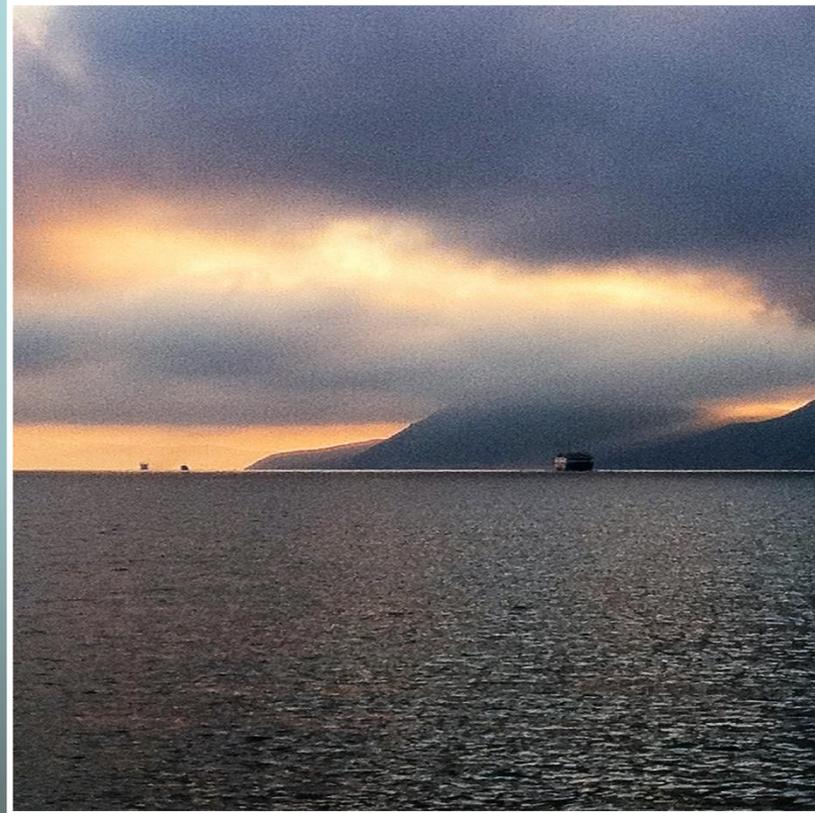


Living within Ocean Boundaries



Professor Michael Depledge CBE DSc FRCP

Ocean Boundaries



Geographical Boundaries

Human influences on Ocean boundaries?

- 2-3 billion increase in population by 2050 in developing countries of the tropics and subtropics.
- More than half of the world's 7.4 billion population currently live in urban settings. Up to 60% by 2030.
- World's 33 mega cities each have > 8 million residents).
- 21 are coastal/estuarine cities – continued migration to coasts.
- 50% of the EU citizens live within 50 km of sea.



Food, shipping and the economy

- Seafood is a vital source of protein (half from coastal aquaculture).
- > 9 billion tonnes of goods shipped around the World by sea each year. This will more than double by 2030.
- ca. 2/3 of the global Gross National Product (GNP) is generated within 100km of the coast.



Humans and the marine environment

- Industrial manufacture is shifting to lower and middle income countries mainly near rivers, estuaries and coasts (with associated pollutant discharges)
- Many adverse impacts of climate change are (& will be) felt by coastal and estuarine communities (sea-level rise, storms, altered precipitation and ocean currents, etc.)



Hurricane Harvey over Corpus Christi



What do we take from the sea?



Benefits from the Sea



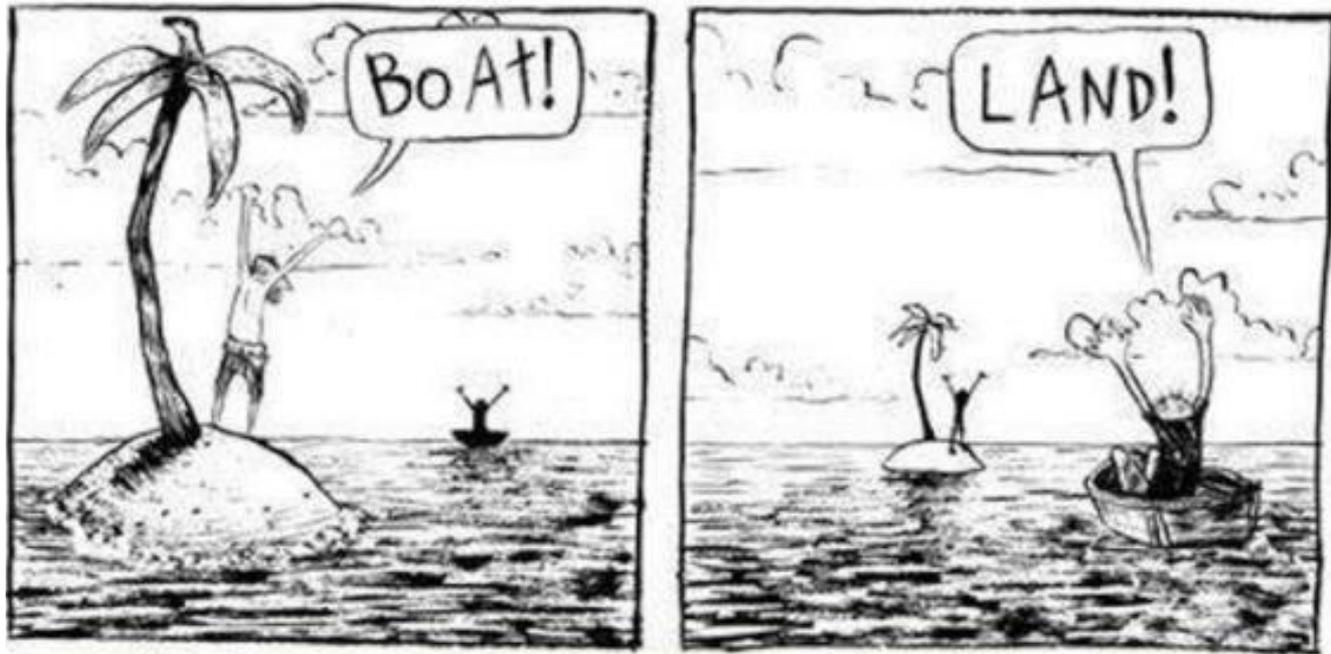
Employment for billions of people:

- capture fisheries & aquaculture - jobs for 10-12 percent of the world's population.
- > 2 billion people work in the marine energy sector, mining industries, maritime transport and tourism.
- Other marine-related jobs: extraction of salt, processing & preserving of fish, crustaceans and molluscs, manufacturing refined petroleum products; the building, repairing and maintaining ships, boats and floating structures, coastal engineering and the construction of flood defences, new ports, coastal towns and cities.

More benefits.....



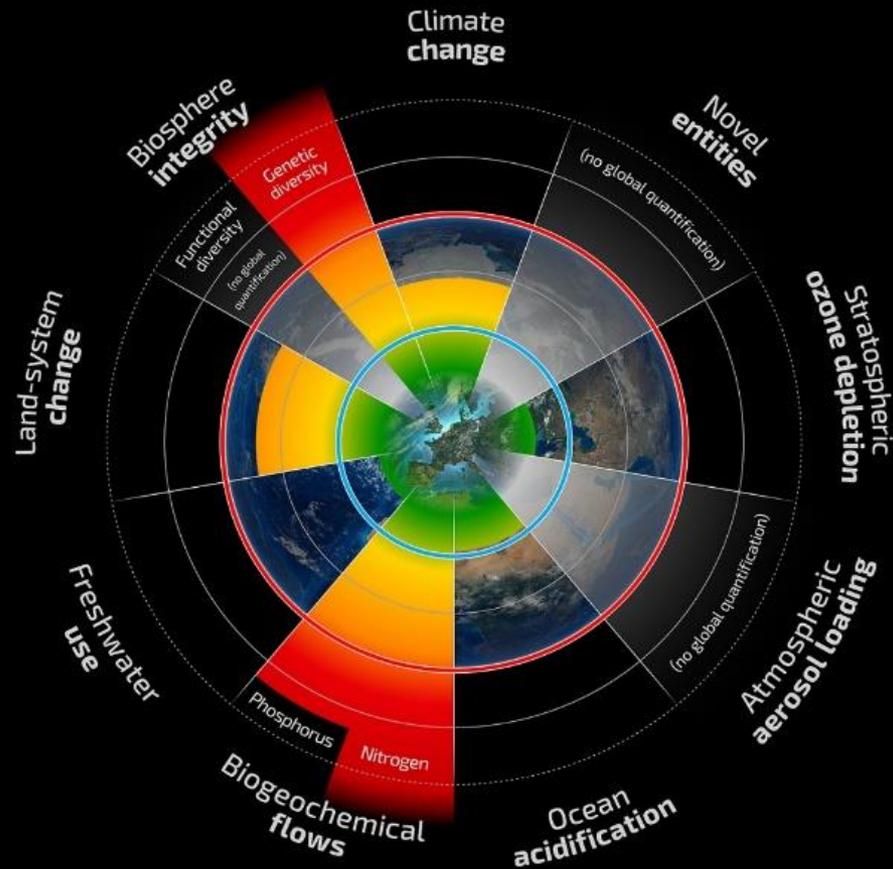
- Fisheries produced ca. 160 million tons of fish (ca. 16 percent of animal protein consumed globally).
- Fish and shellfish rich in omega-3 fatty acid - “Mediterranean diet” >> health and wellbeing improvements, cardio-protective effects, reduced incidence of mammary and prostate cancers. Benefits for neurological function .
- New pharmaceuticals: Ecteinascidin 743, is a potent anti-cancer drug derived from the Caribbean sea squirt,
- Anticancer agents called dolastatins, from sea hares, *Dolabella auricularia*.
- Conotoxin, a potent anti-pain drug, from marine cone shell.
- Brevenal from the Florida Red Tide alga for treating cystic fibrosis.



Perspective.....

Planetary Boundaries

A safe operating space for humanity



- Beyond zone of uncertainty (high risk)
- In zone of uncertainty (increasing risk)
- Below boundary (safe)
- Boundary not yet quantified

Source: Steffen et al. Planetary Boundaries: Guiding human development on a changing planet. *Science*, 16 January 2015.
Design: Globalia



European Centre for
Environment & Human Health

Health impacts in coastal communities

- **Coastal Flooding:** ca. 1560 flood disasters - 1994-2004.
Killed **120,000**, affected 2 million.
- **Hurricanes and Typhoons:** Mitch, Honduras, Oct 1998. **18,000 deaths**.
Katrina, USA, Aug. 2005. **1800 deaths**
Haiyan, Philippines, Nov 2008, **5200 deaths**
Harvey, Irma, etc.....
- **Earthquakes and Tsunamis:** **226,000 deaths** - 13 countries over 10 yrs.
150,000 additional deaths due to disease.
- **Infectious Diseases:** >700 million live near coasts - discharge raw sewage >> **120 million cases** GI disease pa.
50 million cases of respiratory disease pa.
4 million cases of Hepatitis A, **40,000 deaths** pa.
ca. 3–5 million cholera cases; 100K –120K cholera deaths pa.



Health impacts in Coastal Communities.

- **Algal blooms:** ca. 60,000 cases of gastroenteritis and respiratory disease from seafood (containing algal toxins) pa. Paralytic shellfish poisoning, amnesic shellfish poisoning, Ciguatera.
- **Drowning:** ca. 372,000 people drown pa.
- **Work-related deaths:** 2000-2006, average annual fatality rate in USA - 115 deaths per 100,000 fishermen. 3 times greater than the next most dangerous occupation. > than 25 times that USA national average across all workers.
- **Recreation in estuarine and coastal areas:** > 355,000 people injured annually in recreational boating accidents, 40% of injuries require medical treatment beyond simple first aid. In Europe, 14,000 - 47,000 injuries occur during water sports and boating every year.



Marine Pollution – Implications for Health

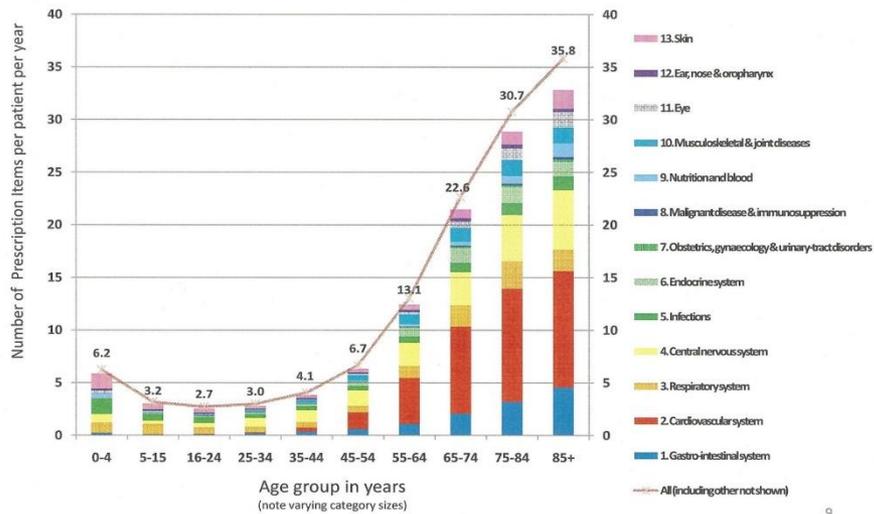


Seafood and contaminants



Pharmaceuticals

Annual prescribing rates by therapeutic group
Males, England & Wales, 1998



Data source: Department of Health, 1998

9

Increasing body burdens of chemicals with age.

Heavy metals

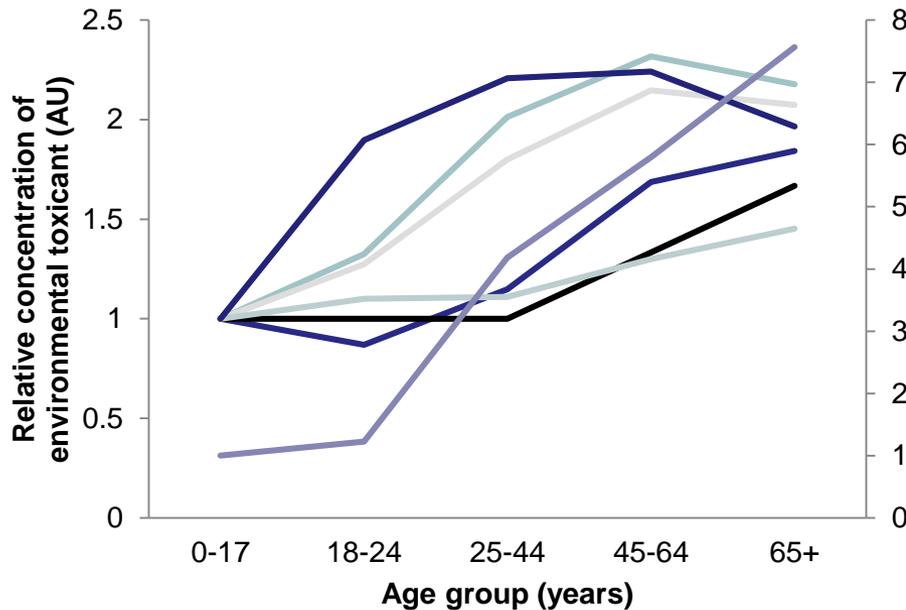
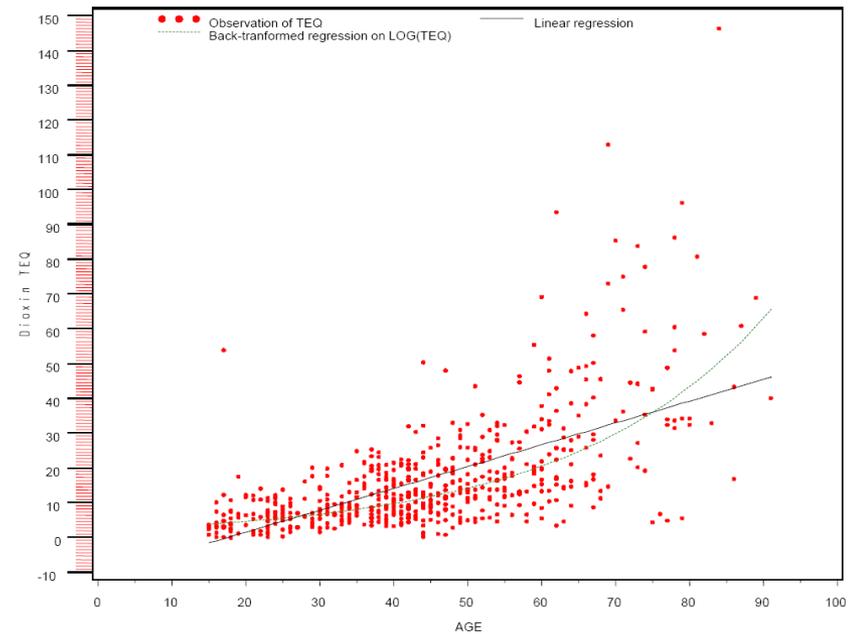
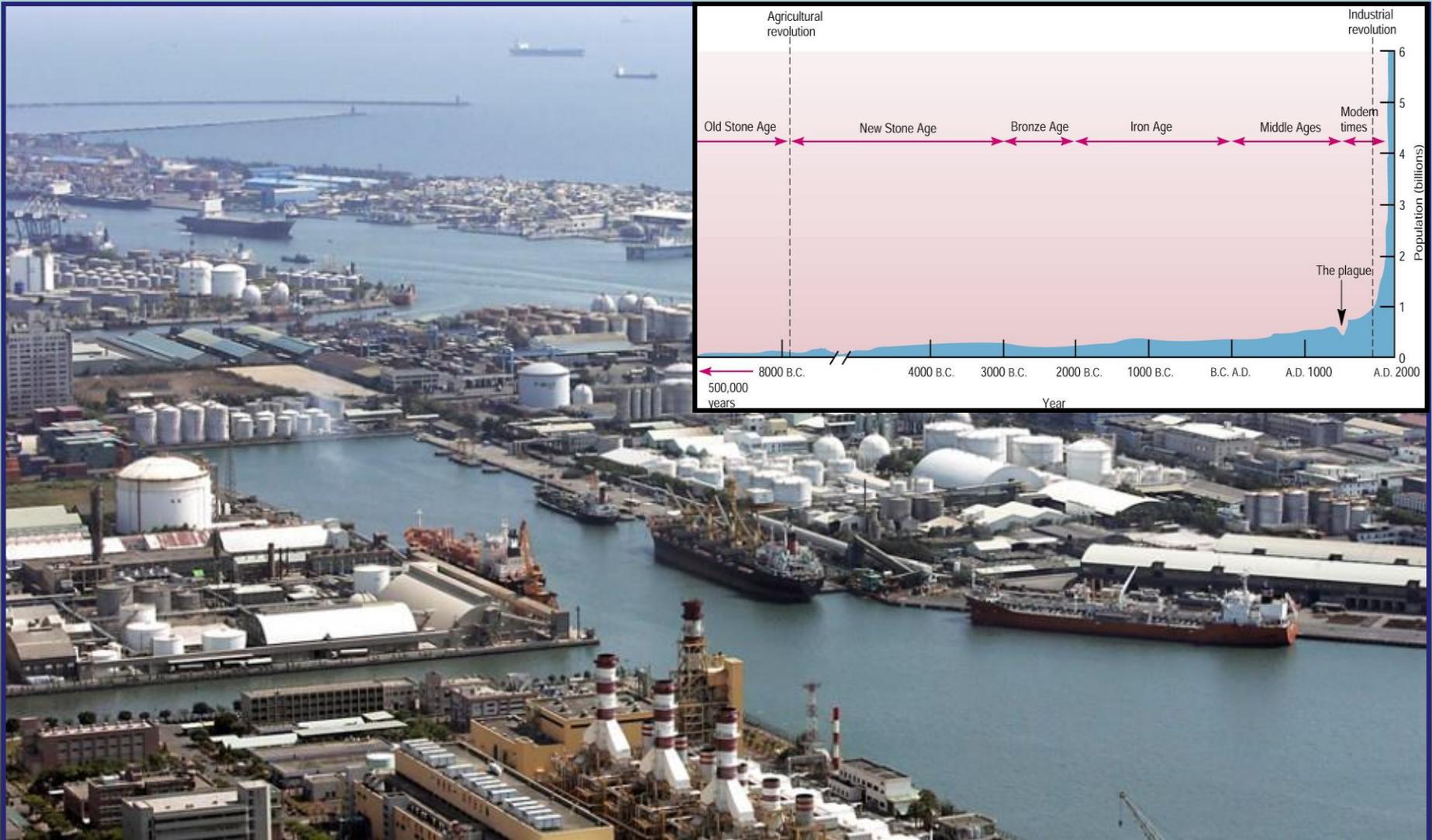


Figure 1. Dioxin TEQ versus Age for Studies from LA, MO, NC, and NY



Rates of change:

How much exploitation can our estuaries, seas and oceans withstand?



Ocean Boundaries: *Ensuring a safe space for living.....*

Heat waves

Ice vortices

Hurricanes

Flooding

**Air
Pollution**

**Chemical
Pollution**

**Food
Security**

**Water
Security**

**Resource
Depletion**

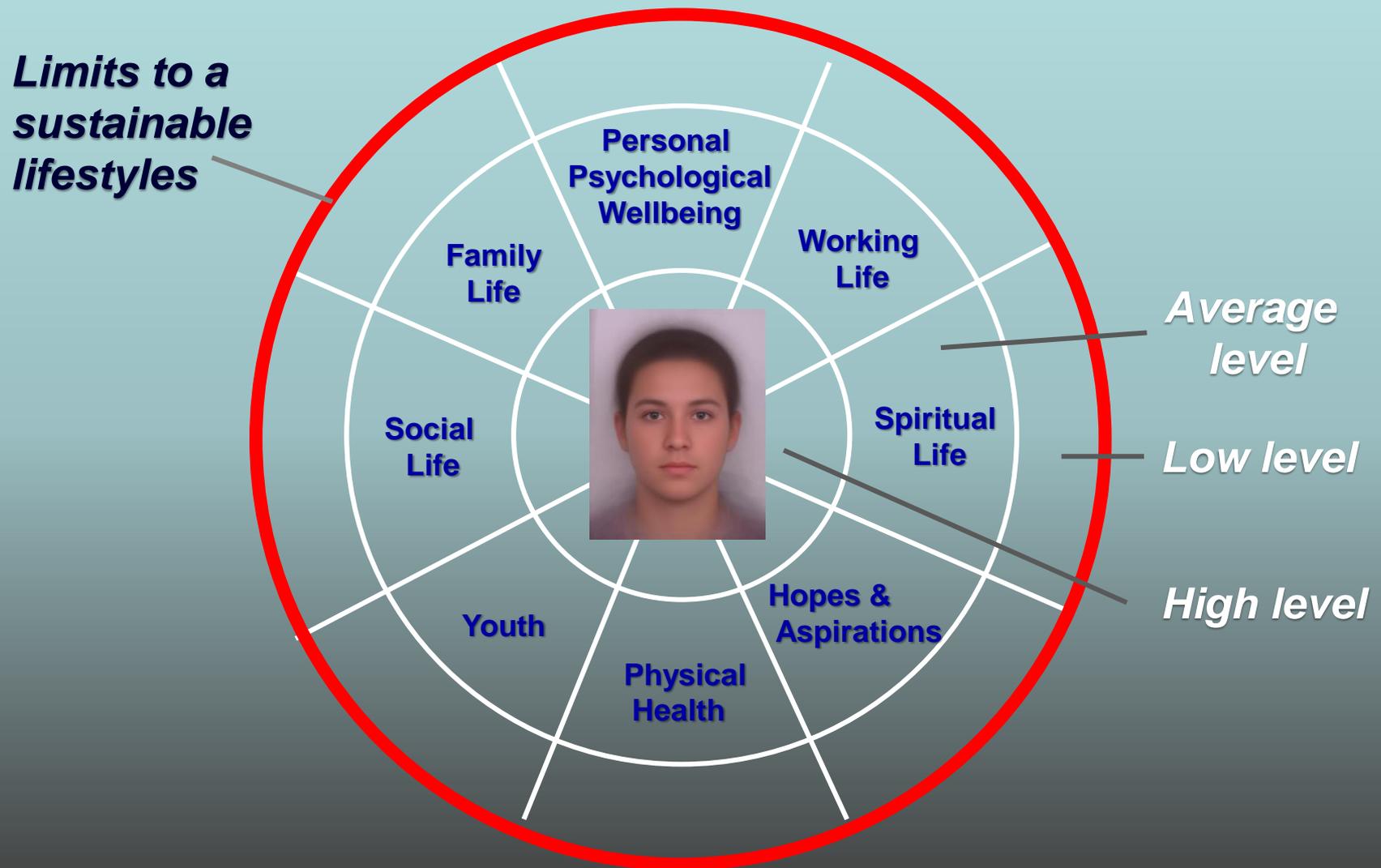
**Energy
shortages**

**Infectious
diseases**

**Biodiversity
loss**

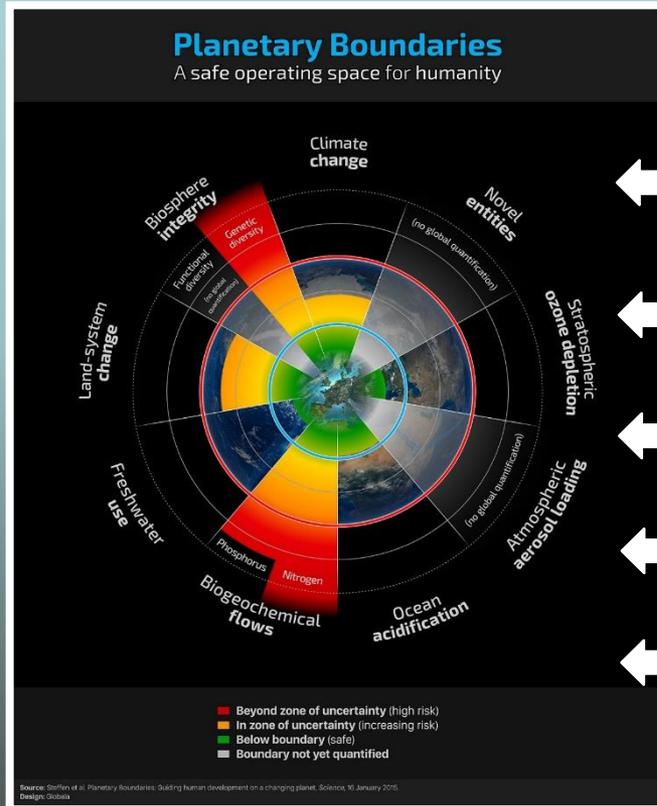


Recognising Human Boundaries

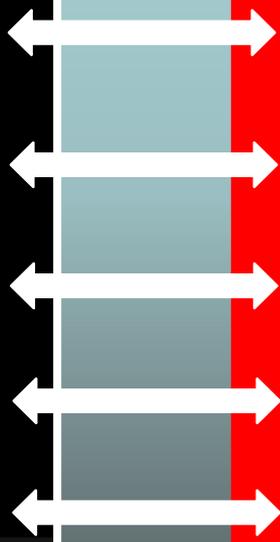


A sustainable operating space for wellbeing

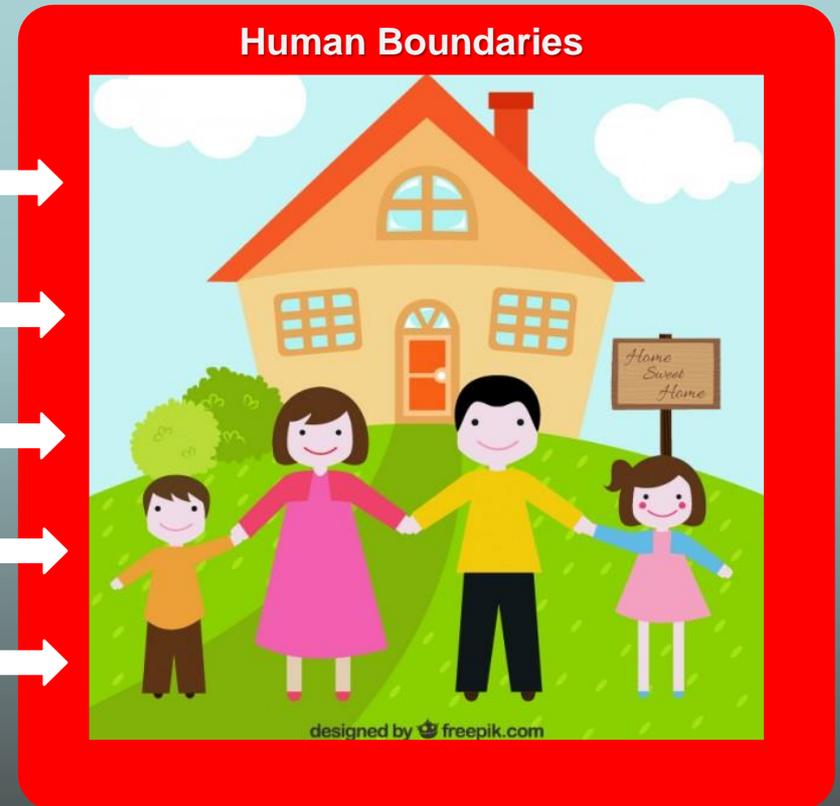
Exploring the interplay among Planetary and Human Boundaries



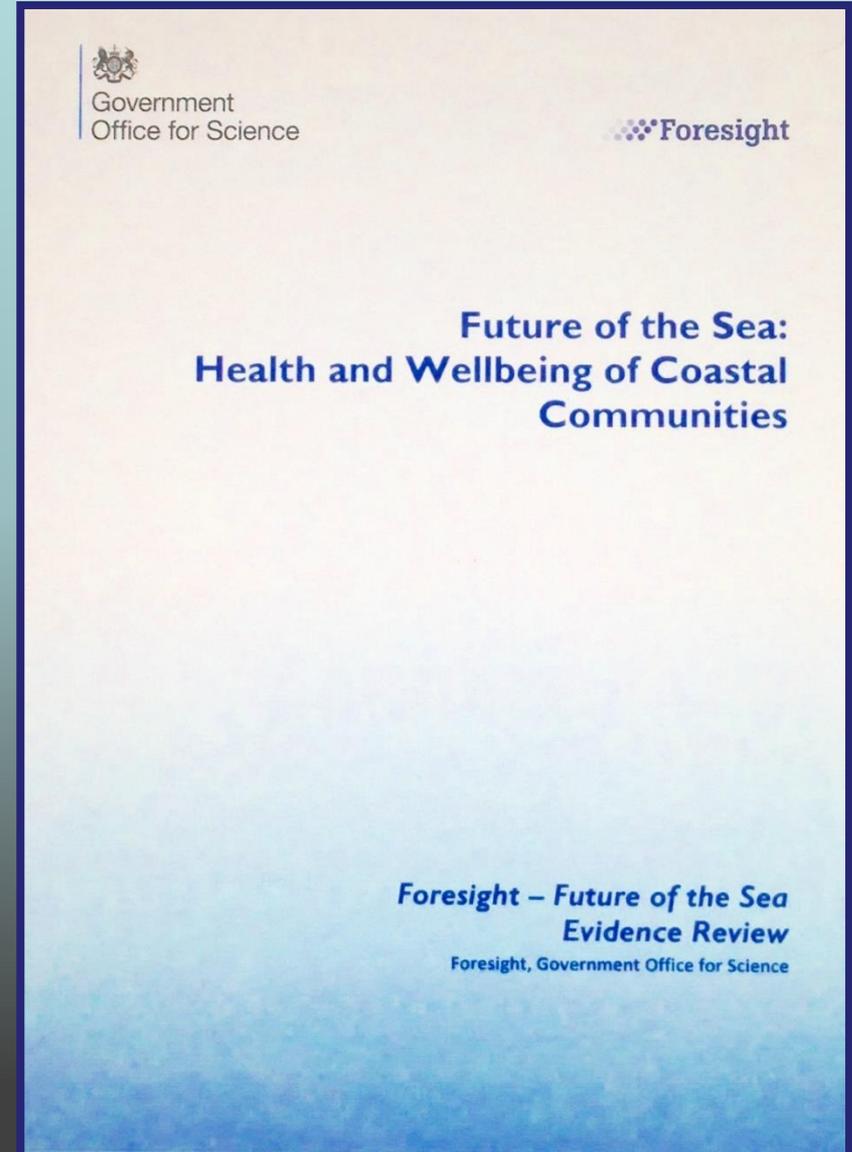
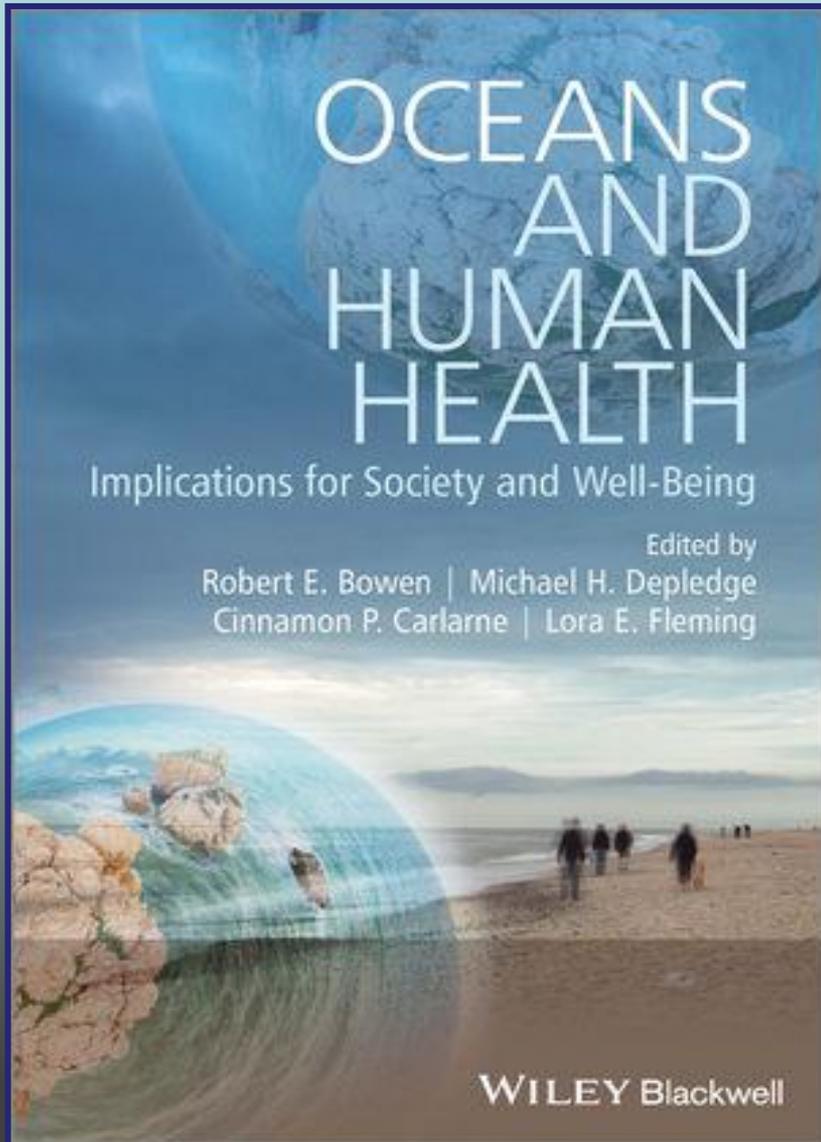
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Oceans and the cost of ill-health to society

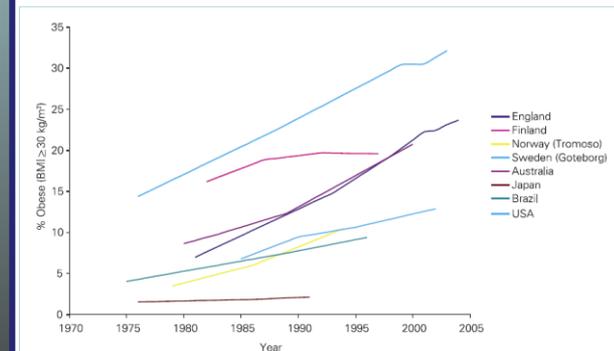


Global Trend of Obesity

- Arthritis
- Breast Cancer
- Heart Disease
- Colorectal Cancer
- **Type 2 diabetes**
- Endometrial Cancer
- End Stage Renal Disease
- Gall bladder Disease
- Hypertension (x5)
- Liver Disease
- Low Back Pain
- Stroke
- Urinary Incontinence



Figure 2.1: Trends in adult prevalence of obesity – percentage of the adult population assessed as obese in a selection of countries from around the world¹¹

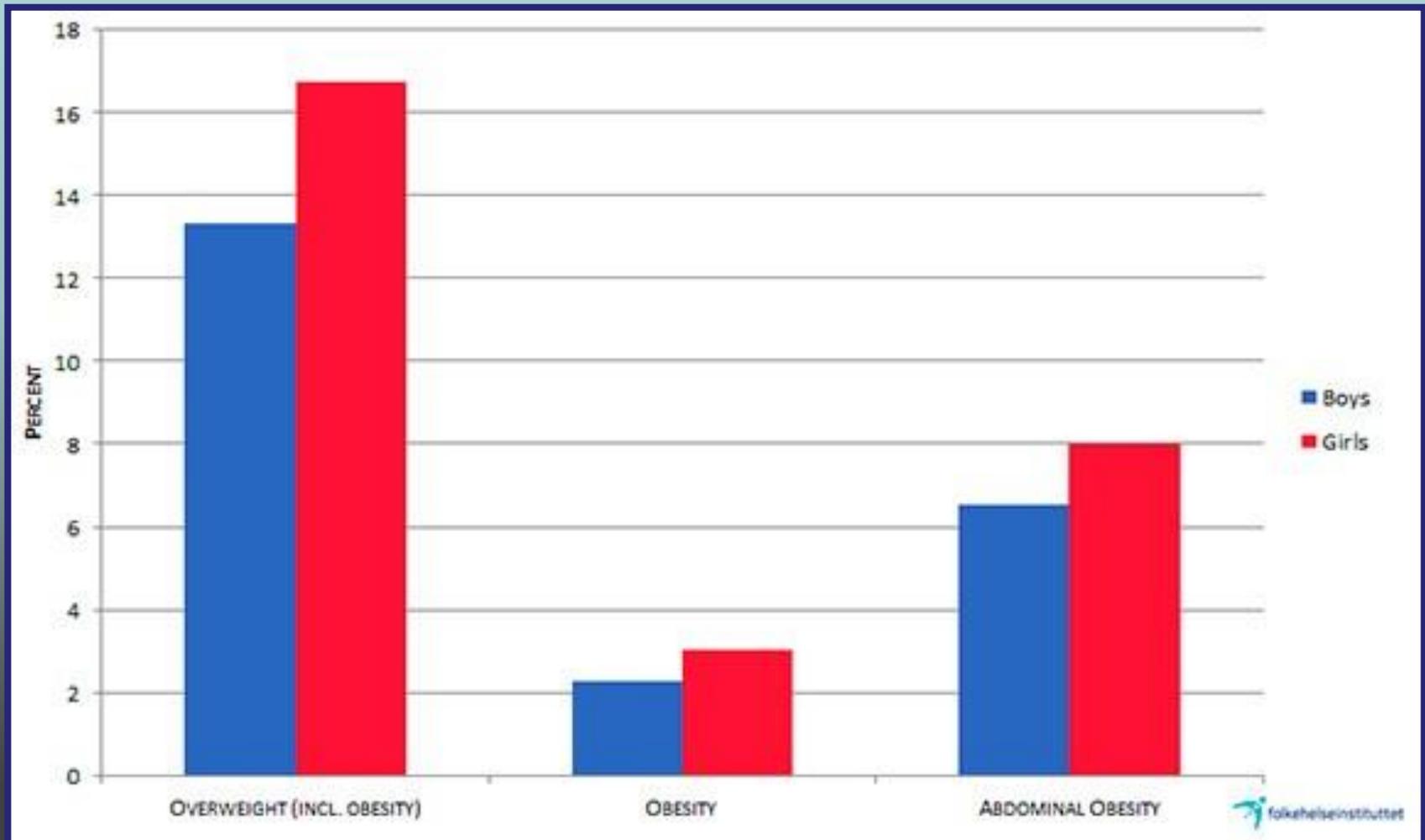


(Cost of Type 2 Diabetes alone is > NKr 5 billion per annum)



Percentage of overweight (including obesity), obesity and abdominal obesity for boys and girls in third grade, 2015.

Source: Child Growth Study, Norwegian Institute of Public Health. The figure comes from the report Children's Health and the Environment – Risk and Health Promoting Factors, 2016.



The Global Mental Illness Epidemic



MENTAL ILL-HEALTH IS A KEY SOCIAL AND LABOUR MARKET POLICY ISSUE

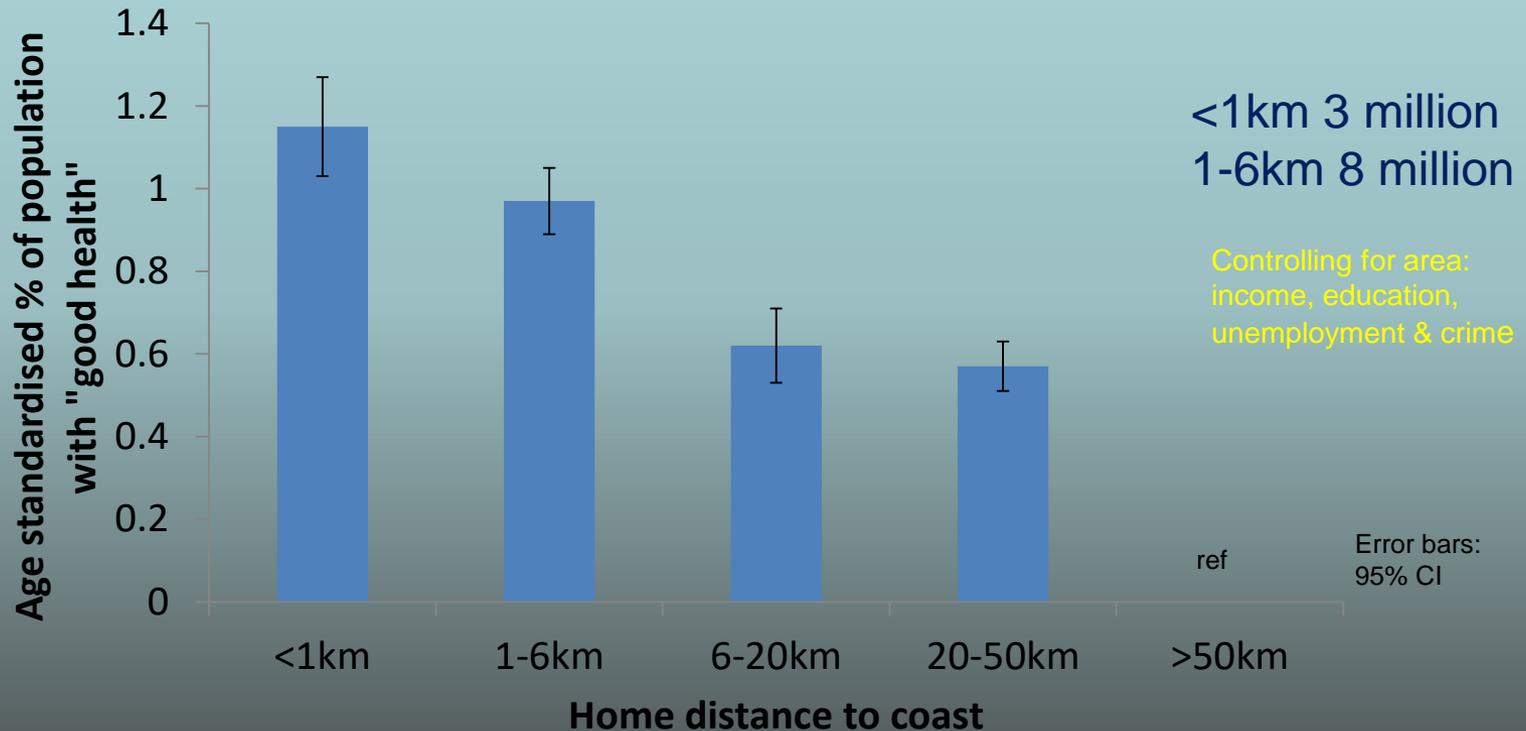
- **Strong employment disadvantage of people with mental disorders:**
 - In Norway as in other OECD countries, the employment rate of people with a mental disorder is between 55 and 70% (depending on the illness severity) - compared to around 85% in healthy people
- **Mental health-related disability benefits have increased**
 - Disability benefit claims due to a mental disorder are on the rise in Norway as in most other OECD countries – in Norway from around 20% of all new claims in 2005 to around 30% in 2011.
- **People with mental health problems have more and longer absences**
 - In the past four weeks, 30-40% of workers with a mental disorder (depending on the illness severity) have been absent from work - compared to around 20% of workers without a mental health problem.
 - The average duration of sickness absence is higher in workers with a mental health problem
- **The productivity losses of workers *not* absent from work are large – this should be the main policy focus in future**
 - 70 to 90% of workers with a mental health problem have had productivity losses due to a health problem – compared to only 25% of workers without a mental health problem

Cost: ca. Nkr 70 million per year.



Does living by the coast improve your health and wellbeing?

Census Data (England, n = 48 million)



The effects are strongest in poorer communities ^a

Same pattern when people move home ^b

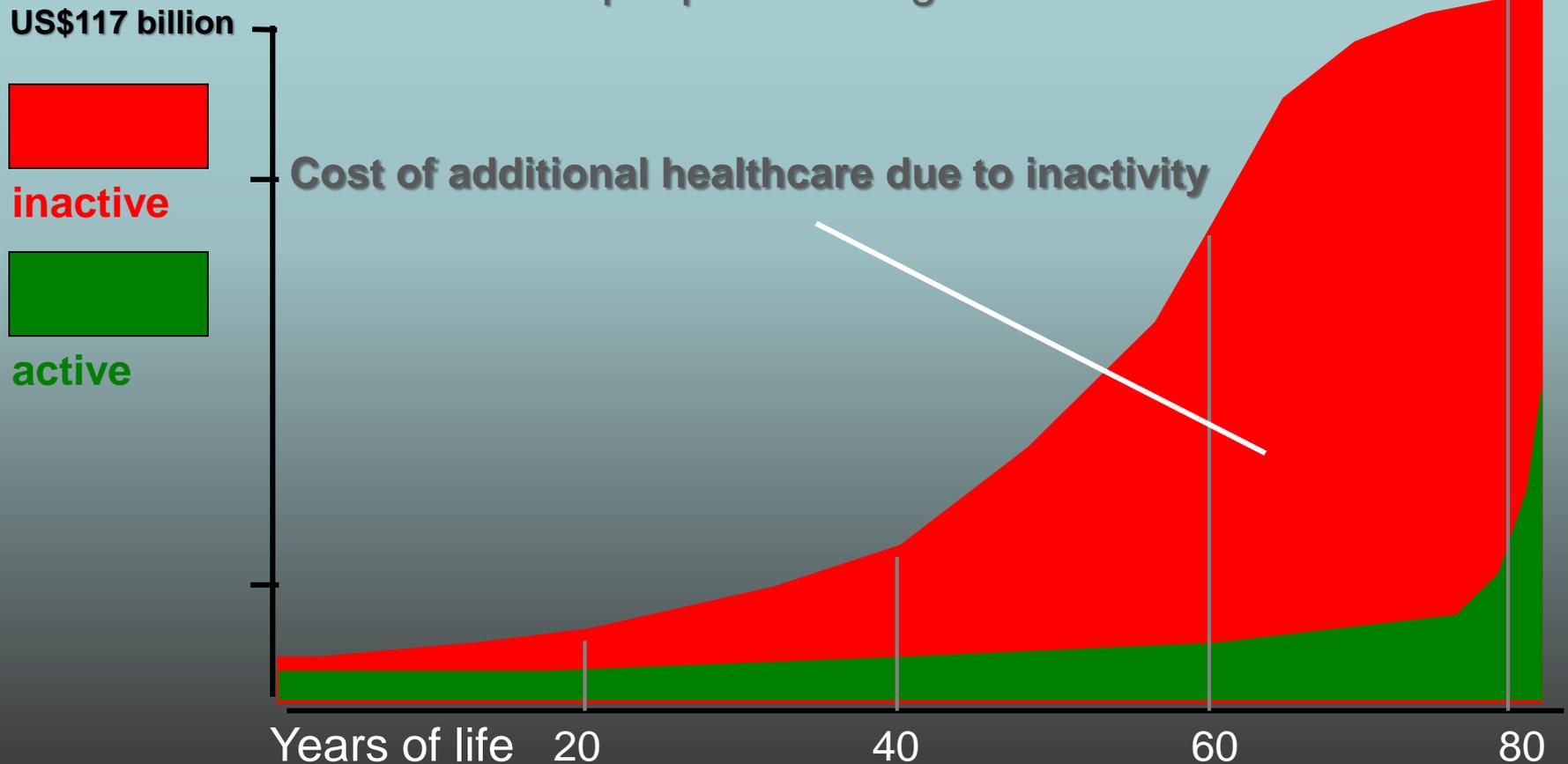
Physical activity improves physiological and mental health in all age groups



Activity outdoors has even greater benefits

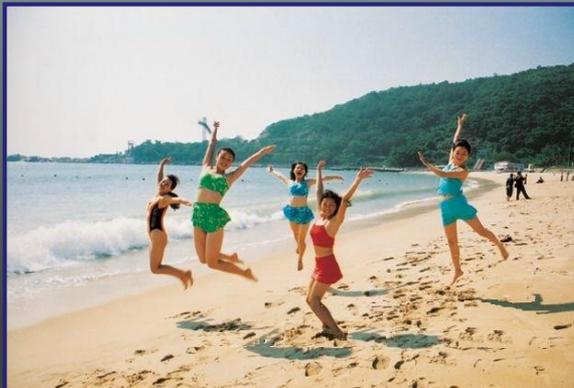
Economic implications of health and wellbeing issues; (The USA as an example)

- Physical inactivity is a major problem.
- Inactive people have higher healthcare costs.



Engage in activities by the coast!

- Children who live within 500 m of accessible blue/green space are 24 % more likely to meet recommended levels of physical activity.
- For example, reducing the sedentary population by just 1 per cent could reduce UK morbidity and mortality rates valued at £1.44 billion



How can we motivate ourselves to adopt sustainable, physically active lifestyles using outdoor natural environments?



From “Blue Gym” to “BlueHealth”



<https://www.youtube.com/watch?v=Jq44KhBSgQA>

An international multi-partner project



Dr Mat White

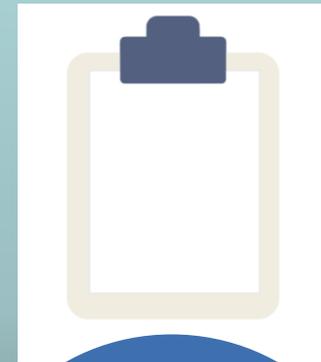


Prof Lora Fleming

“BlueHealth” Survey



- Comprehensive pan-European survey
- Administered to 13,000 people in 14 EU countries
 - All partner countries and Bulgaria, Czech Republic, Finland, France and Portugal
- + 4,000 in Australia, Canada, California, Hong Kong
- Will shed light on
 - Physical activities near water sources
 - Effects on mental health
 - Differences between countries



13k+



Seas, Oceans and *Public Health in Europe* (SOPHIE)



A strategic research agenda for Europe and beyond

SOPHIE will:



Build a diverse network of stakeholders across Europe involved in oceans and human health



Set a Strategic Research Agenda in Oceans and Human Health for Europe



Create a legacy that advances the field across the World



European Centre for
Environment & Human Health

The Bio-Economy

Economic activity generated through innovative alternatives in food, feed, bio-based products, and bioenergy developed from renewable biological resources across industries like agriculture, forestry, fisheries and aquaculture, pulp, paper and more.



AND enhance the health, wellbeing, prosperity and security of citizens

The bio-economy presents alternatives to over-exploitation of natural resources, focusing on efficient and innovative use of renewable biological resources with fewer inputs, less environmental impact, and reduced greenhouse gas emissions.

Points to reflect on.....



- The key purpose of any economy is to enhance the health, wellbeing and prosperity of citizens.
- Human health, wellbeing and the (marine) environment are interdependent. One will not thrive without the other. A balance is required
- In making a transition from an economy based on exploitation of natural resources to a sustainable bio-economy, ecological boundaries must be identified, understood and respected.
- Unexpected consequences can be minimised by adopting interdisciplinary approaches. (minimising threats and capitalising on opportunities)
- Failure to respect planetary and human boundaries ultimately jeopardises economic development.

“Life is like riding a bicycle. To keep your balance you must keep moving.....”

Albert Einstein



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