A short-lived FAD in the Pacific: Implications and Adaptations in the Move to Biodegradable Fish

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Moving to Biodegradable FADs

Recommendations from all tuna RFMOs to move towards **FAD constructions** with increasing **biodegradable components**

Research and development of designs is ongoing, with **recent trials showing 4-month lifetimes** for bio-FADs with conventional designs, and **10 months+ for JellyFAD designs**

Fishers have indicated that the ideal lifetime of a FAD is one year, enabling time to drift and fishing operations to occur

The **shorter lifetimes** of these bio-FADs will **reduce marine pollution** and related impacts, but also **result in a reduction of potentially operational FADs** when they prematurely breakdown within the fishing zone

Drift Simulation Experiments

Predicting such impacts is difficult

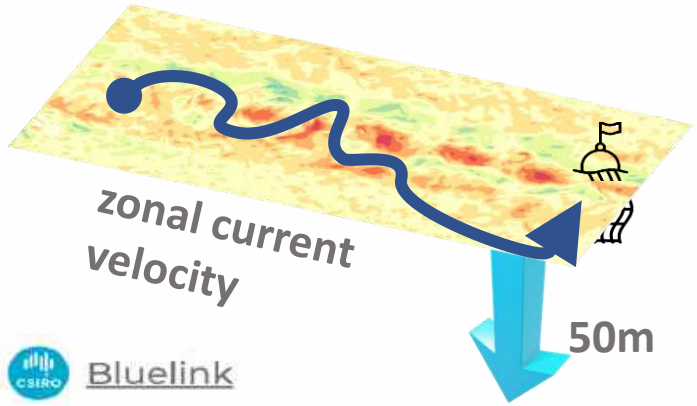
- **Lack of complete data** for drifting FADs
- Particularly as **FADs that drift out of the equatorial fishing zone** are deactivated

Lagrangian **simulations provide a useful tool** in these cases

Using **physical ocean circulation** models and known **deployment distributions**, broad-scale drift **patterns can be predicted**

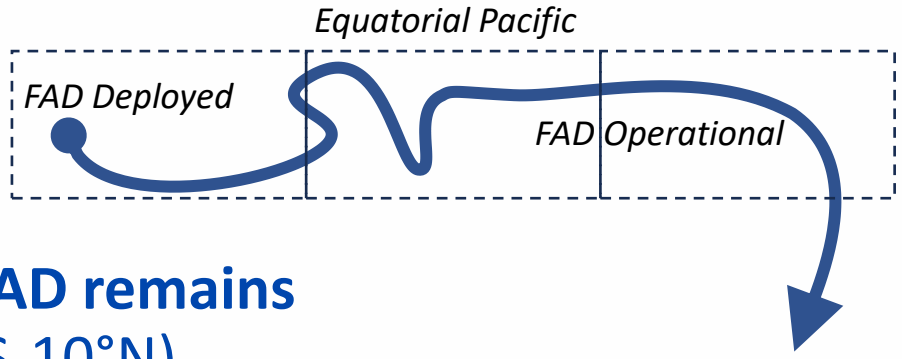
We simulated the drift of FADs over 10-years, assuming different physical BioFAD lifetimes

- A 1/10°, **high-resolution physical ocean** model (BRAN2020)
- 'Virtual FAD' particles seeded over ten years, with a **spatial distribution calculated from observed FAD deployments** in the WCPO and EPO



Drift Simulation Experiments

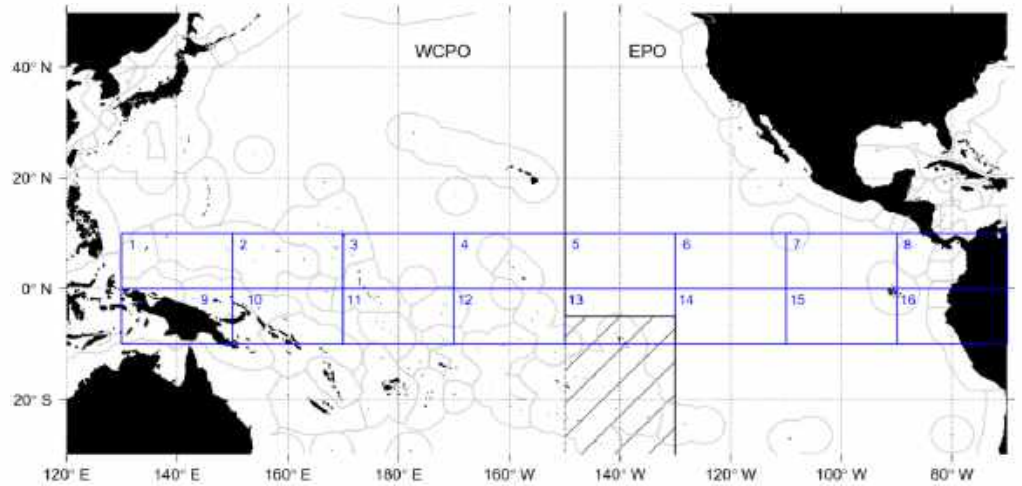
Definitions



- *Deployment:* the area in which a **virtual FAD is seeded** before drifting
- *Operational lifetime:* the period of time that a **FAD remains drifting within the equatorial fishing zone** (10°S-10°N)
- *Lost:* any FAD that **drifts outside the equatorial zone**
- *Physical lifetime:* the **assumed breakdown of the FAD**, dependant on scenario, regardless of whether it is still *operational* or *lost*

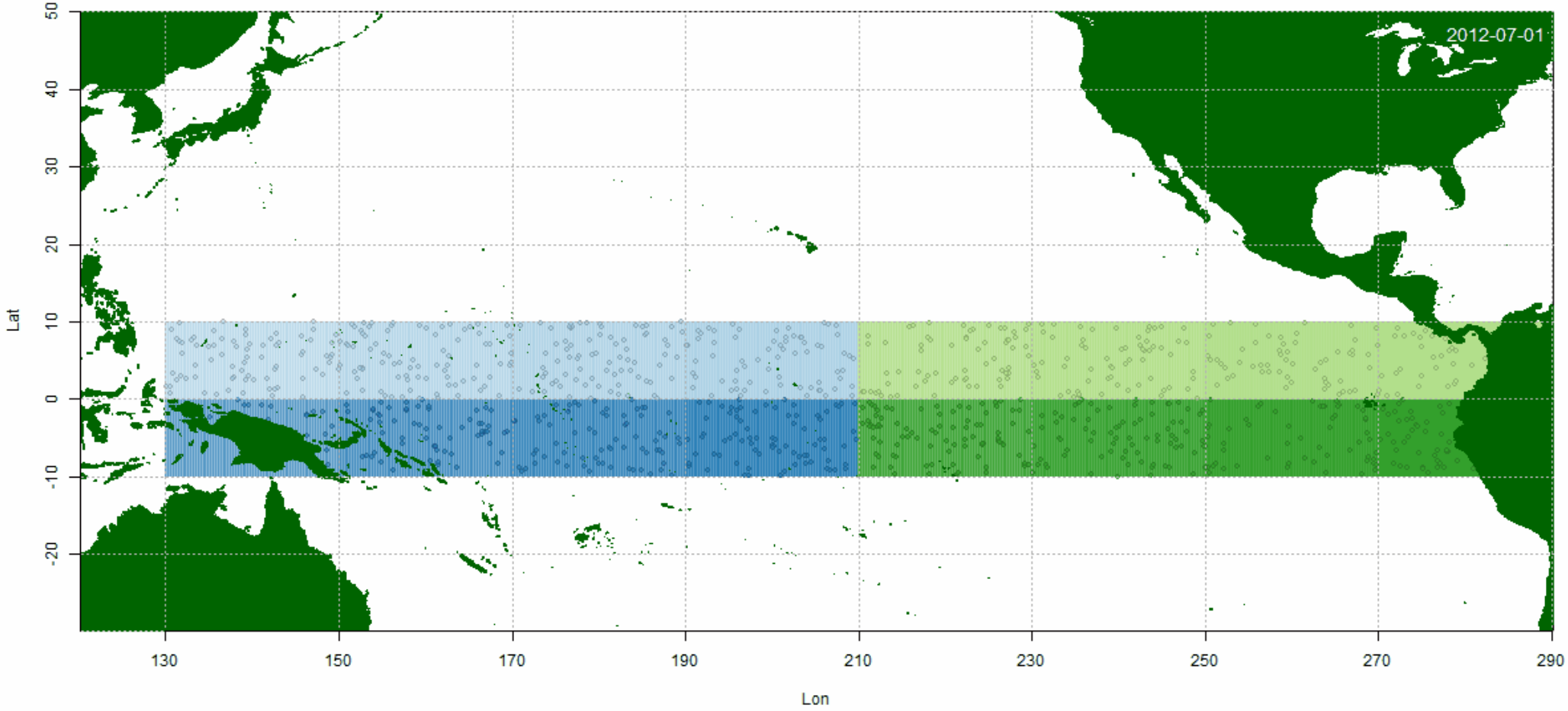
FADs trajectories are recorded **across and out of 16 equatorial zones**

Advected by the **top 50m** of ocean current velocities



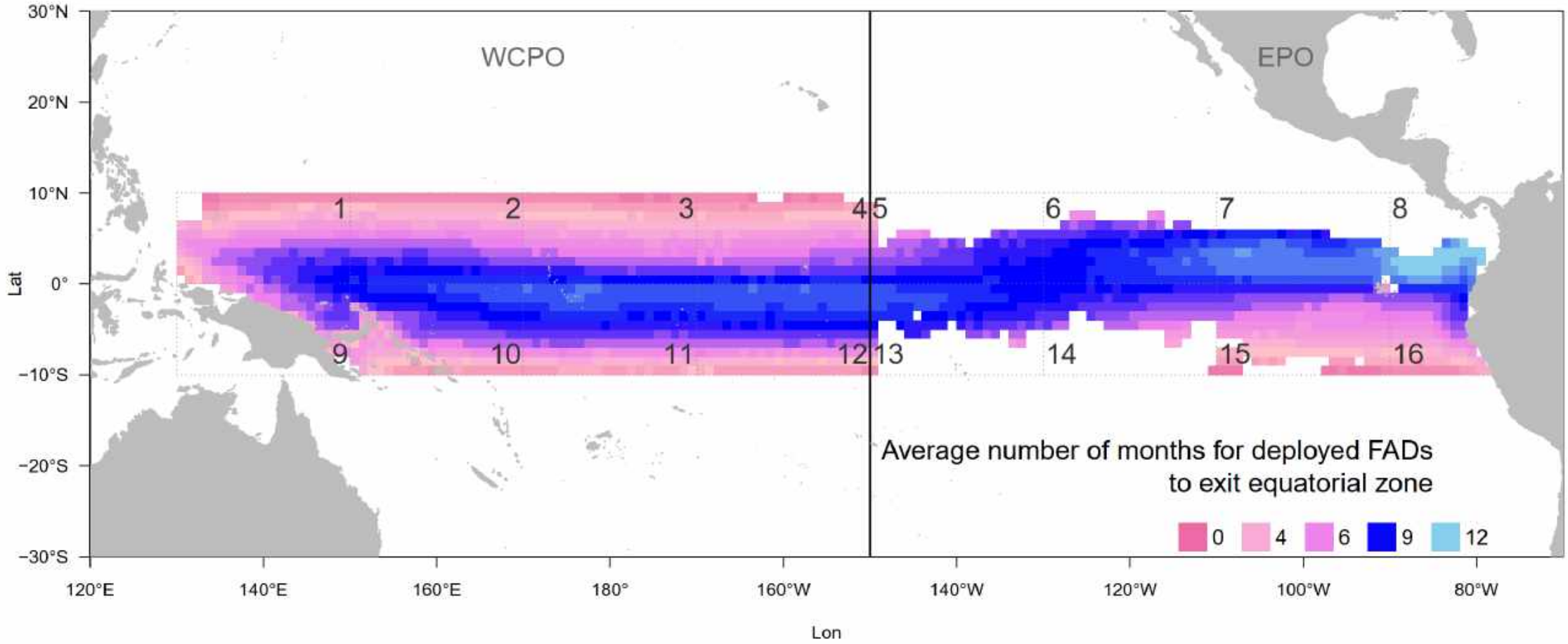
Simulation Experiments Results

Status Quo scenario assumes FADs drift with a **physical lifetime of two years**



Simulation Experiments Results

Longest operational times in the **far-eastern EPO**, and **southern-equatorial WCPO**

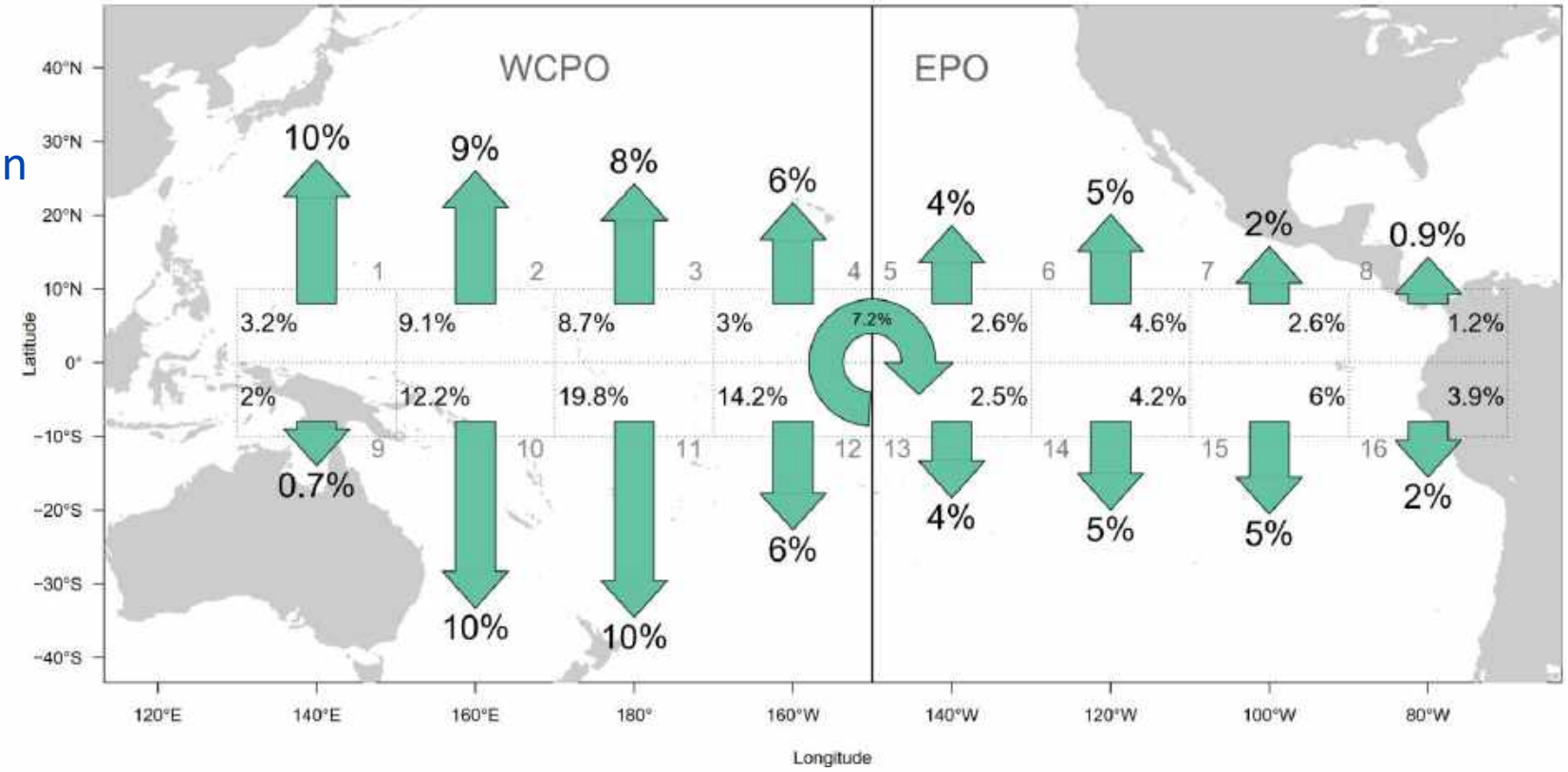


Results: Two year *status quo* lifetimes

Corridors of loss (status quo scenario)

- Greatest number of FAD deployments in southern WCPO
- Greatest EPO deployments in central regions

- **Largest exit** of *lost* FADs out of **southern WCPO**
- **Only 7.2% of FADs still *operational*** within equatorial fishing ground after two years

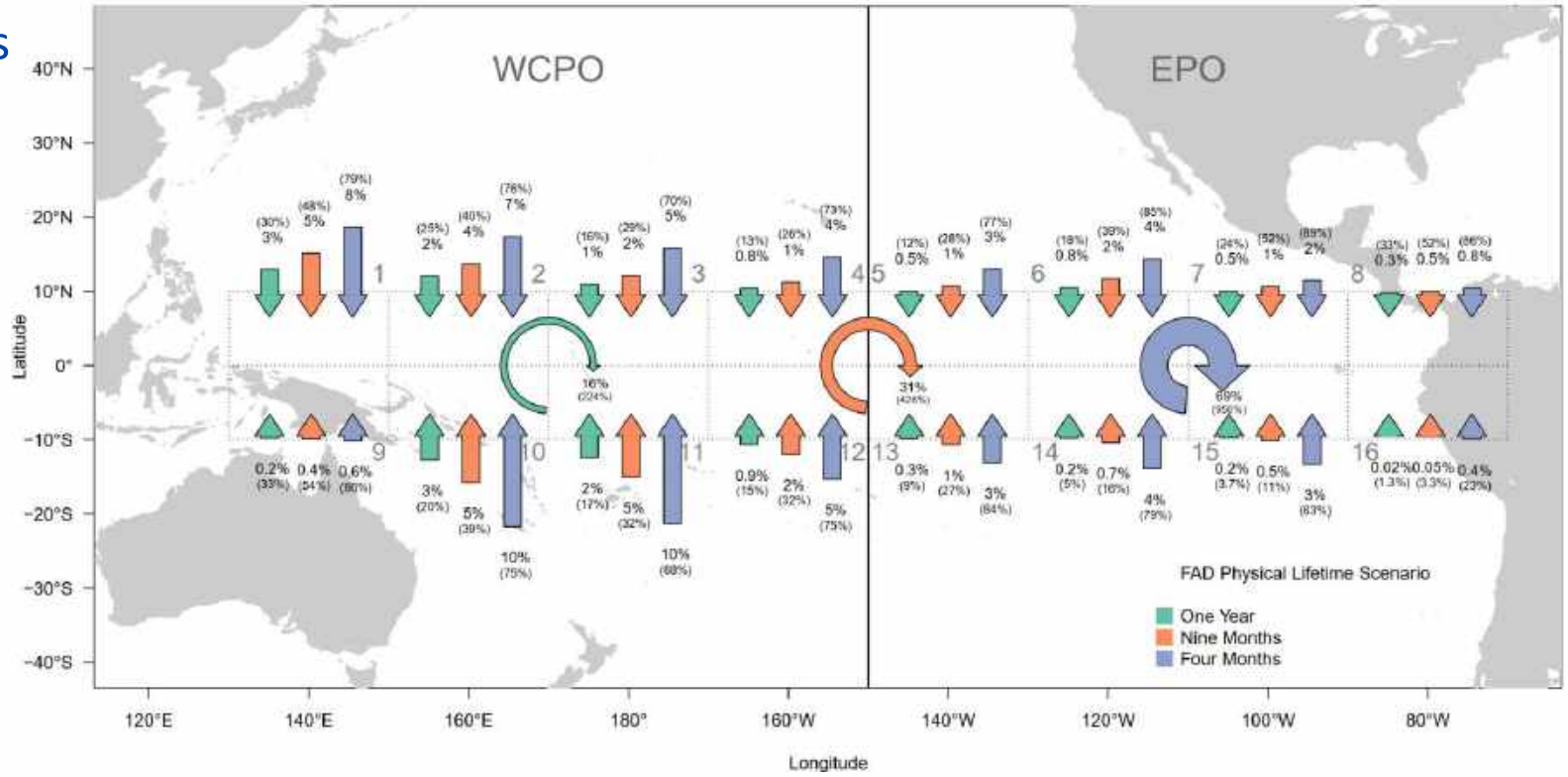


Results: BioFAD lifetime scenarios

Reduction in *Lost* and *Operational* FADs under bio-FAD scenarios

When considering bio-FADs with 4- to 12-month lifetimes:

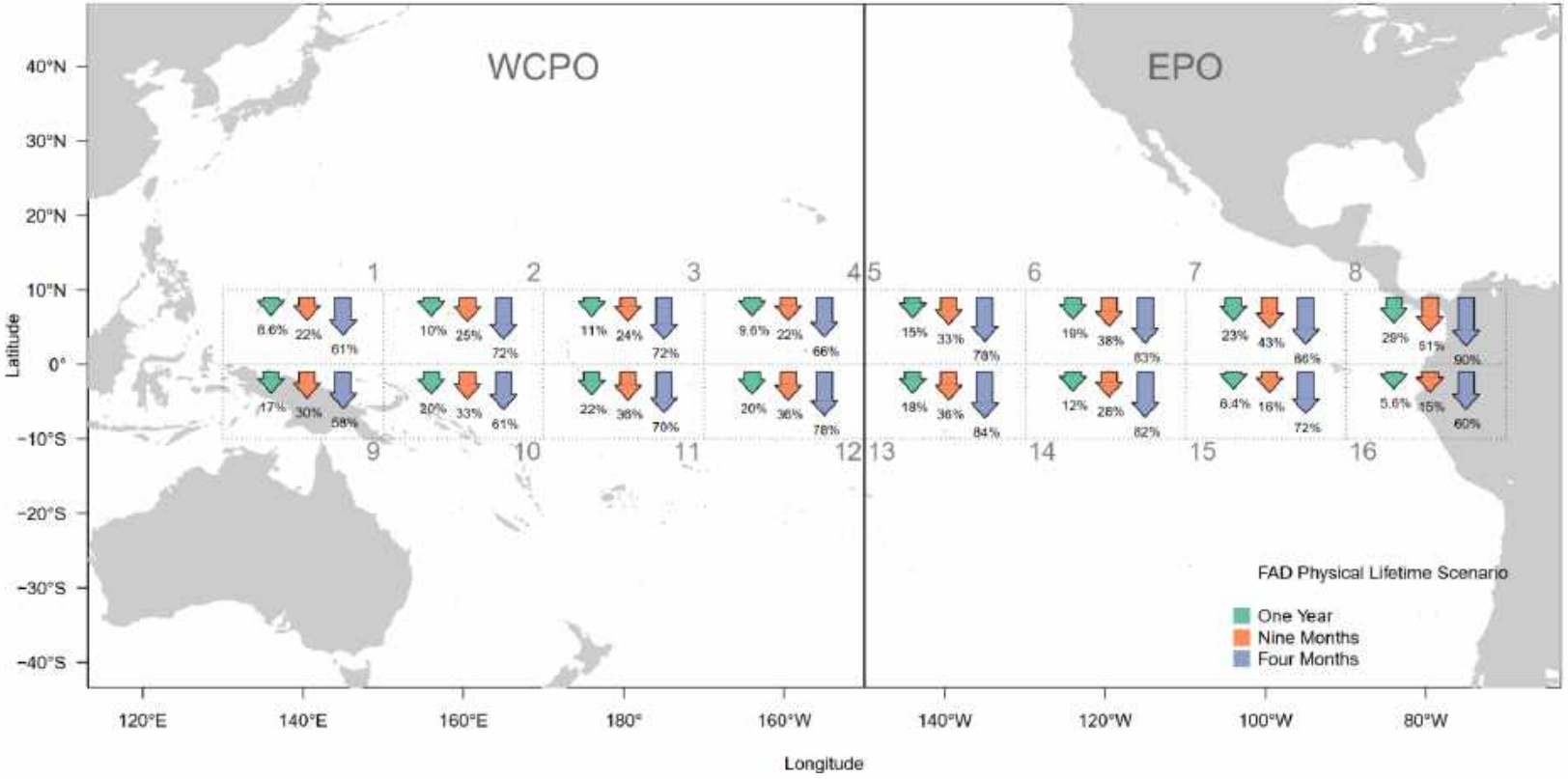
- Largest reduction in *lost* FADs in EPO
- Large reduction out of far western WCPO
- Results in necessary increase in *operational* FADs that prematurely breakdown
- 4-month bioFAD lifetime results in 324% more FADs that prematurely breakdown
- One year lifetime results in 1056% increase



Results: BioFAD lifetime scenarios

Reduction in *operational* FADs by *deployment* region

- Greatest reduction in *operational* FADs deployed in EPO
- Also considerable reduction for southern WCPO deployed FADs
- Assuming a one-year bio-FAD lifetime, most regions experience a ~10-30% reduction in the number of operational FADs still drifting in the equatorial fishing ground



Implications

The uptake of **biodegradable FADs will cause a clear and widespread benefits** in the reduction of lost FAD marine debris and its associated impacts.

This will be **most apparent** for regions south of the **Solomon Islands**, north of **Palau and FSM**, and along the **coast of central America**.

However, this will **also result in a significant loss** in potentially operational bio-FADs **due to breakdown whilst in the fishing zone**

The **biggest loss** will be for bio-FADs **deployed in the northern EPO**, and the **central Pacific** from 130°W to 150°E

Adaptations

In light of premature bio-FAD loss, there is **potential for a compensatory deployment effort** by some purse seine fleets.

Such **an increase in deployments will have implications** for fishing operation **costs**, vessel active **FAD limits** and **ecological impacts** within the fishing ground (e.g. beaching on equatorial reefs).

However, **not all FADs** that drift in the equatorial zone are **operational**. When FADs drift out of an owner's fishing range, if they are not passed on to other fleets, they are effectively no longer operational.

Increased coordination of passing FADs on to other fleets, and **repairing still operational bio-FADs** before they breakdown may mitigate against these losses

More **work required** on **spatial FAD-fishing operation** dynamics, and **influence of sea-state on bio-FAD lifetimes**