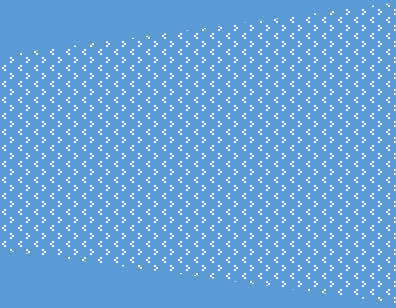
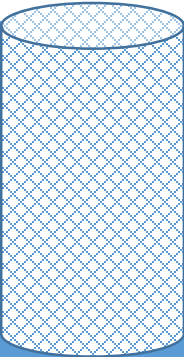
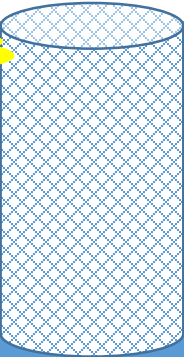


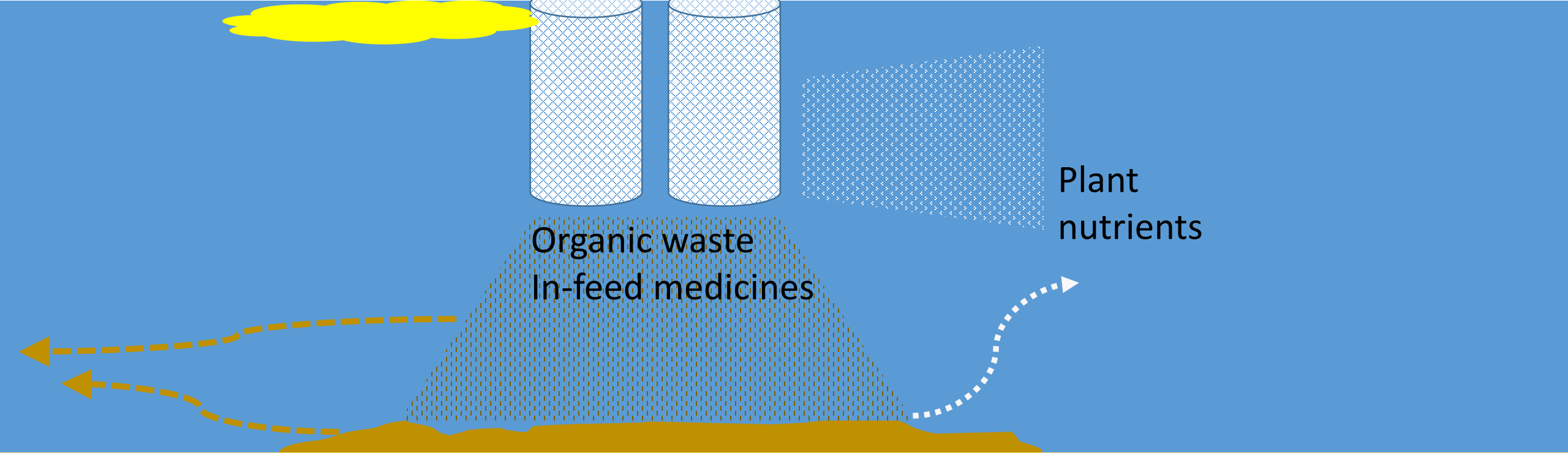
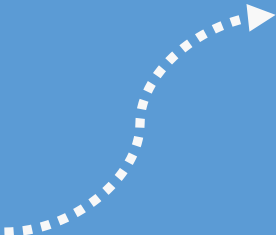
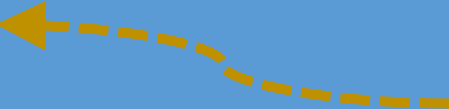
Baseline surveys & operator monitoring

Bath medicines

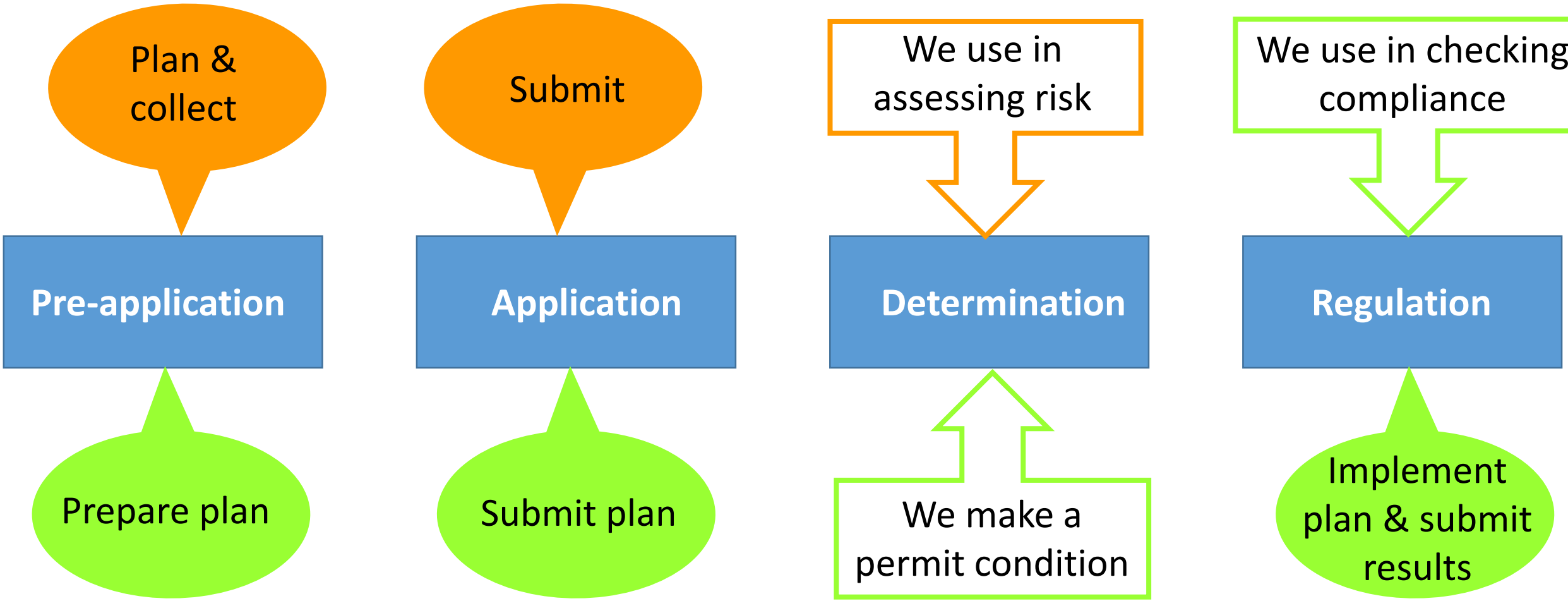


Plant nutrients

Organic waste
In-feed medicines



Baseline information



Monitoring

Baseline surveys

Deposition & hydrodynamic model outputs

Sensitive features
Seabed type
Ecological quality
Carbon
*Medicine residues**
*Nutrients**

Modelled risks

Baseline survey plan (*what, where, how*)

Check common understanding

Undertake survey

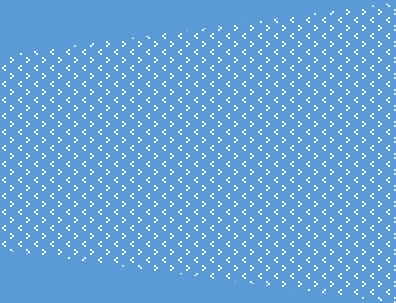
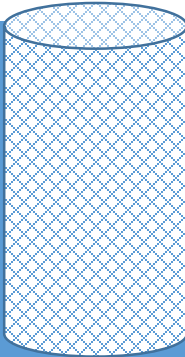
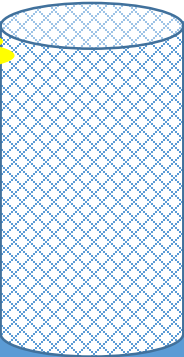
Application

• Data reporting

• Area around mixing zone
• Wider risk areas

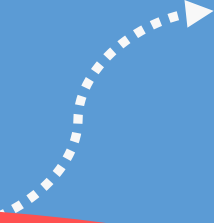
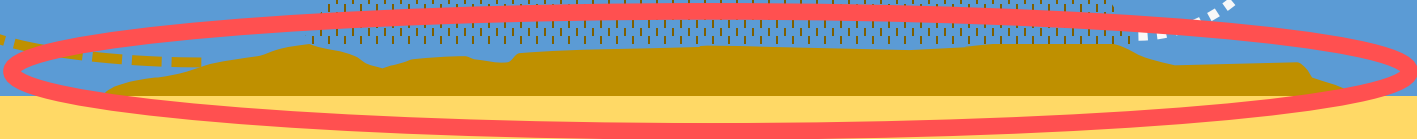
• Standard methods of sampling & analysis

Bath medicines



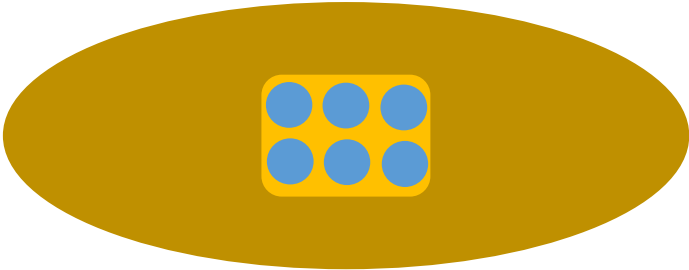
Plant nutrients

Organic waste
In-feed medicines

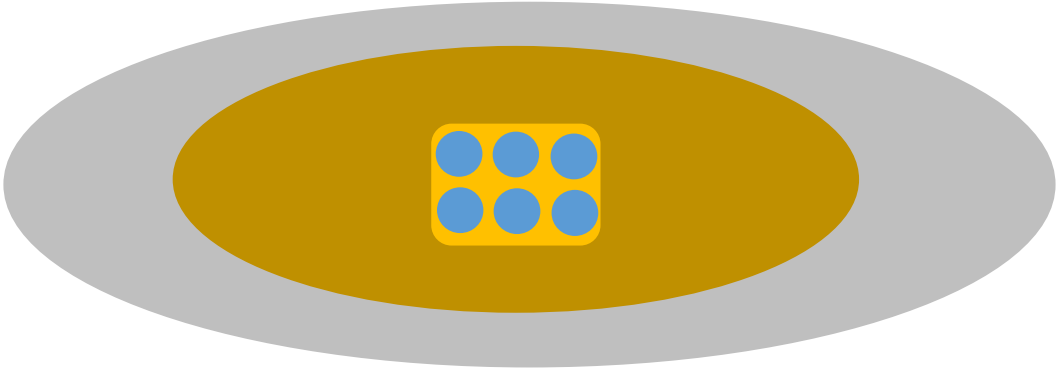


Baseline survey area around mixing zone

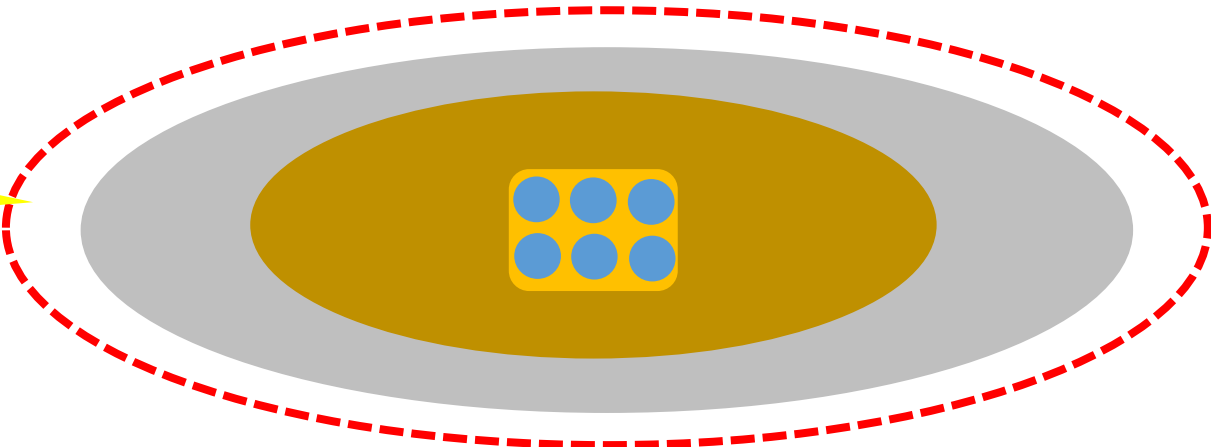
Modelled footprint



100 metre mixing zone



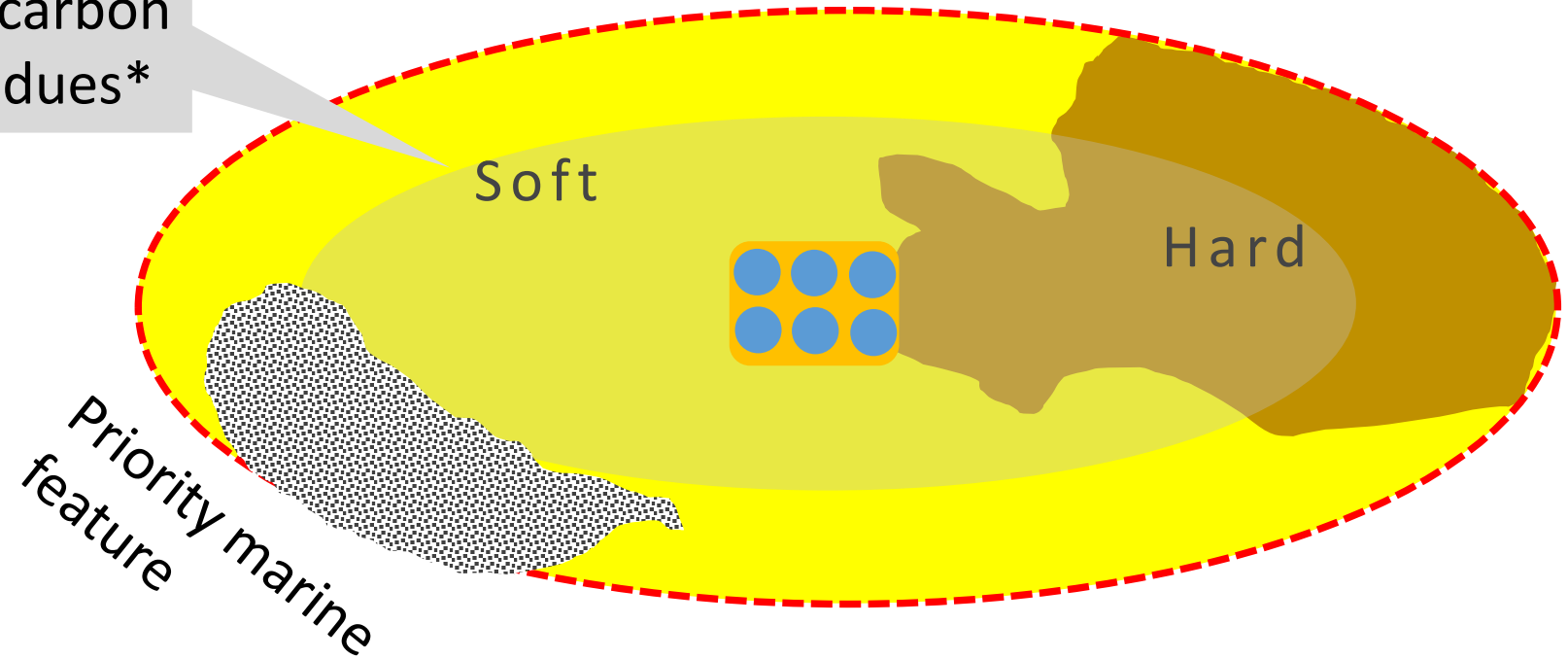
Greater of:
150m from cage edge; or
100m mixing zone + 50m



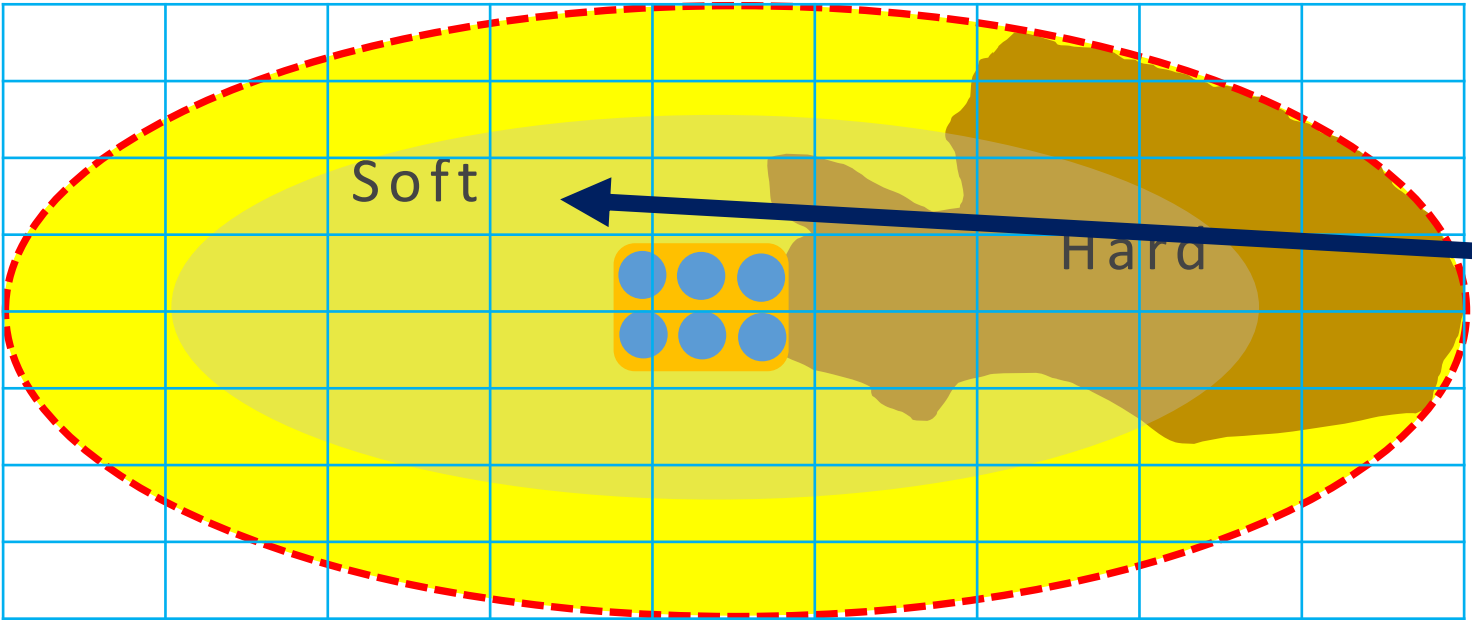
Baseline survey area

Baseline survey - what

- Invertebrates
- Total organic carbon
- Medicine residues*



Baseline survey - how



QUESTIONS

Operator monitoring

Modelled risks & baseline info.

Pre-application common understanding

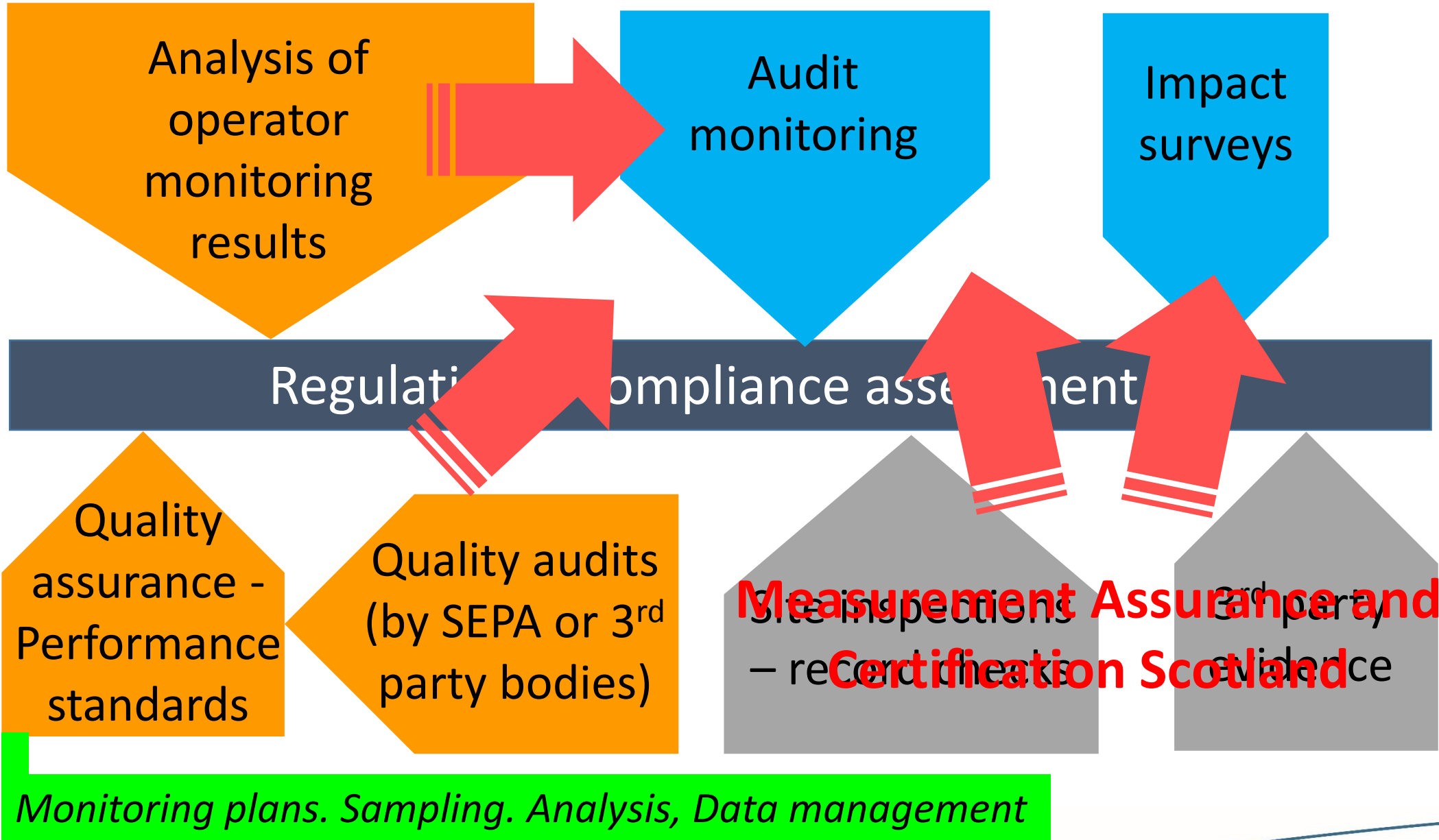
Monitoring plan (*where, what, how & when*)

Right plan avoids delay or rejection

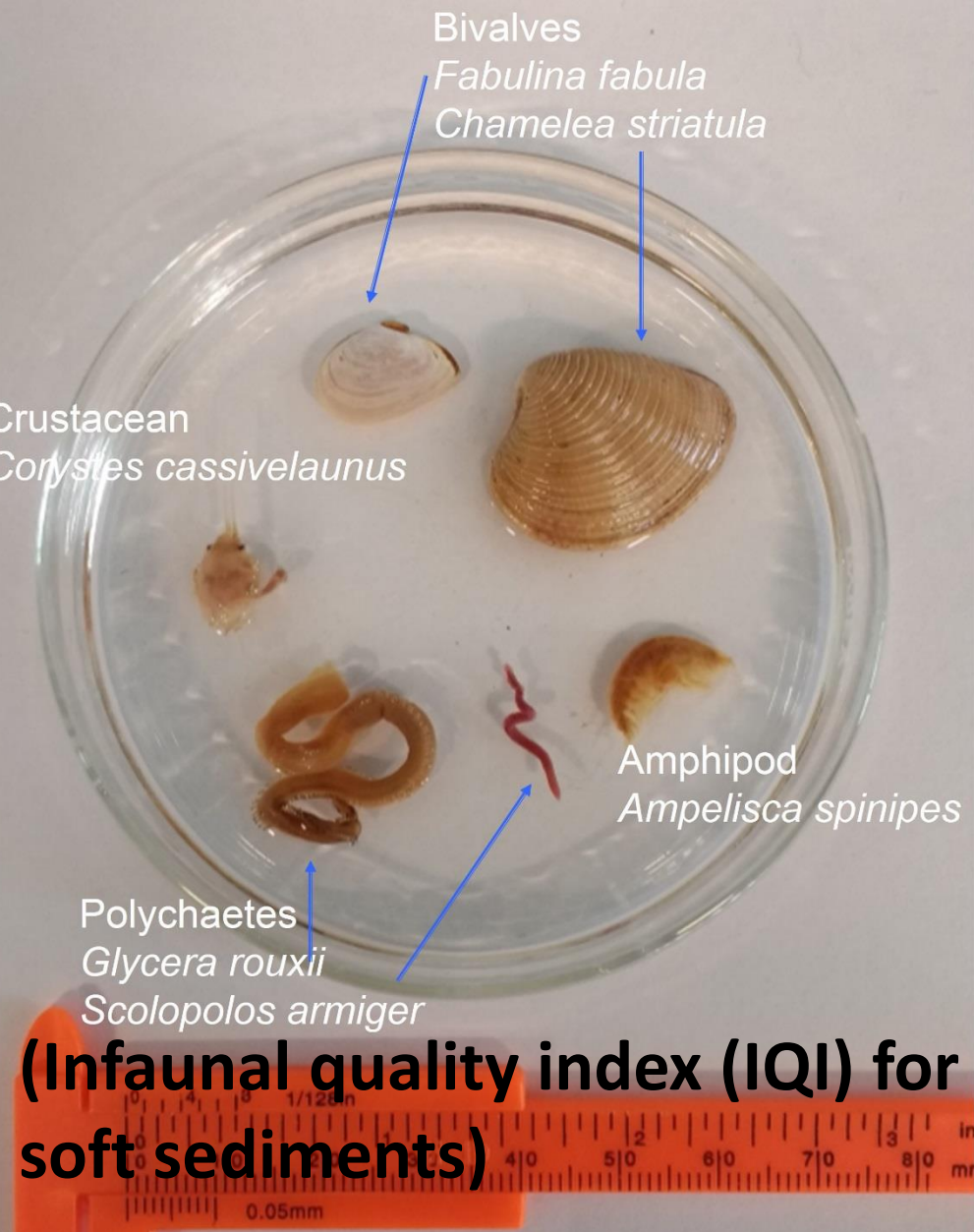
Application

Operator monitoring

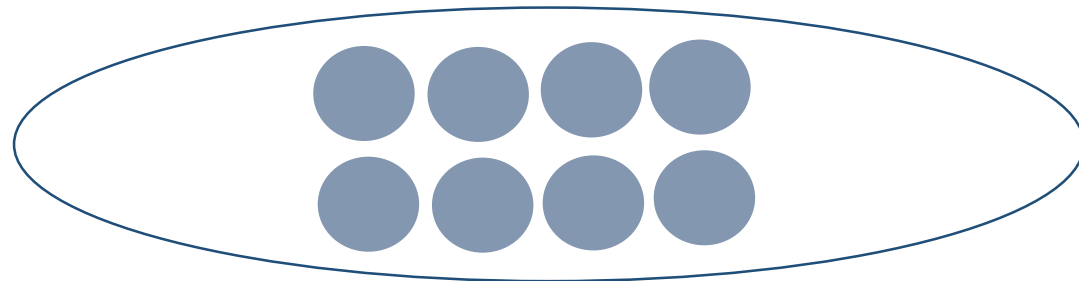
Monitoring design & data quality suitable for compliance assessment



Mixing zone “area” standards



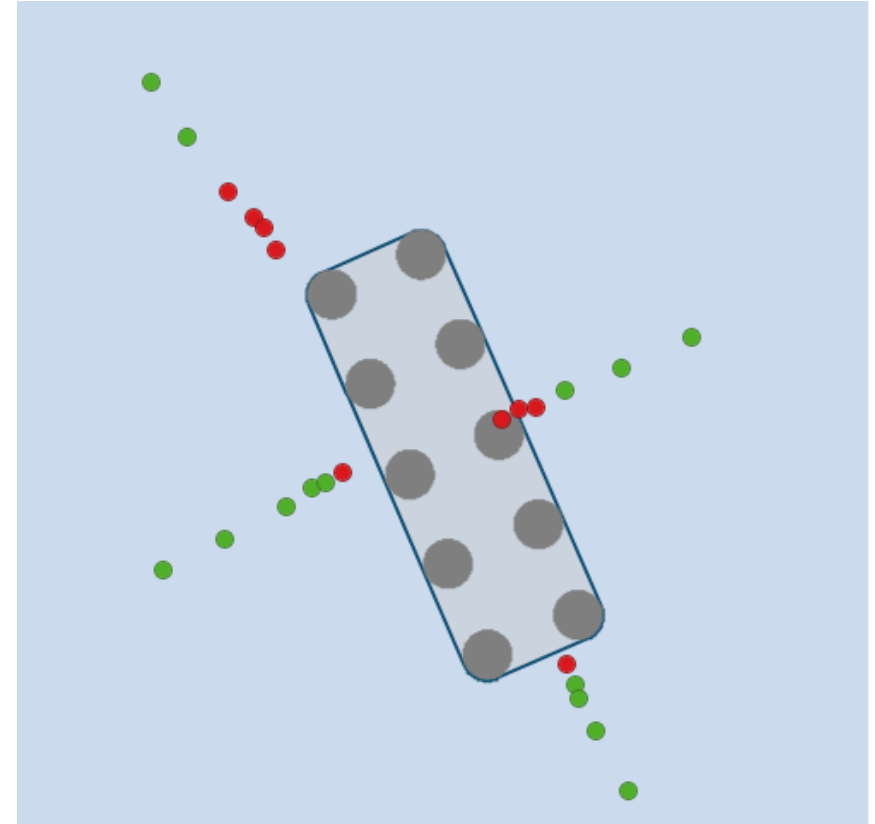
- Environmental standards for medicines
- Sea bed biological standards



Area standards – compliance method (sampling)

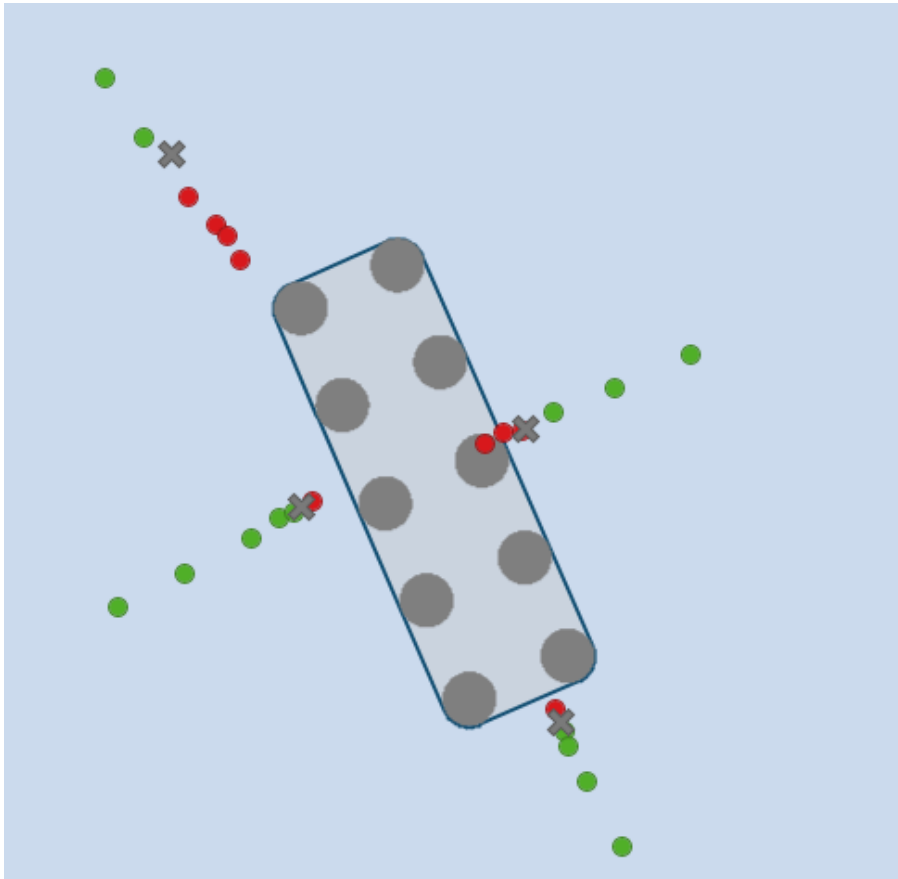
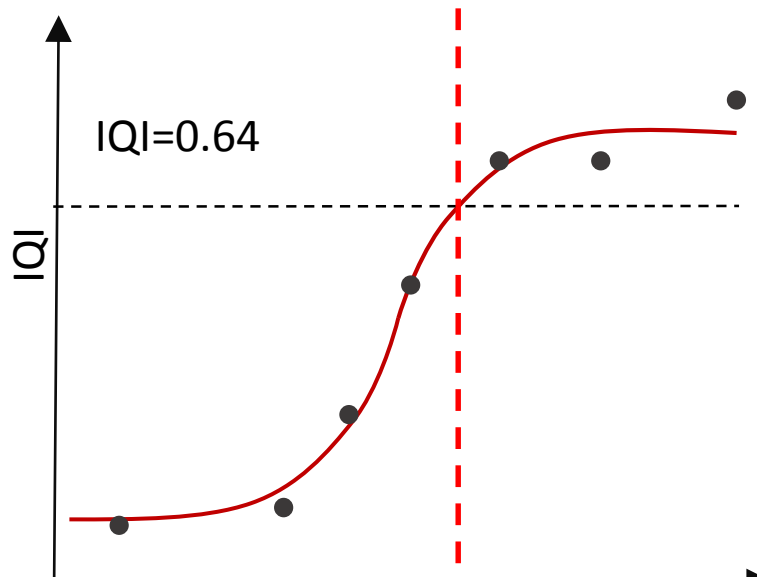
Require a method to move from sampling points to impacted area

- 1. Sample IQI with sufficient transects & sampling points around the fish farm**
2. Determine for each transect a distance at which IQI breaches 0.64
3. Use a spanning ellipse anchored by the above breach distances to determine the area impacted



Area standards – compliance method (breach distances)

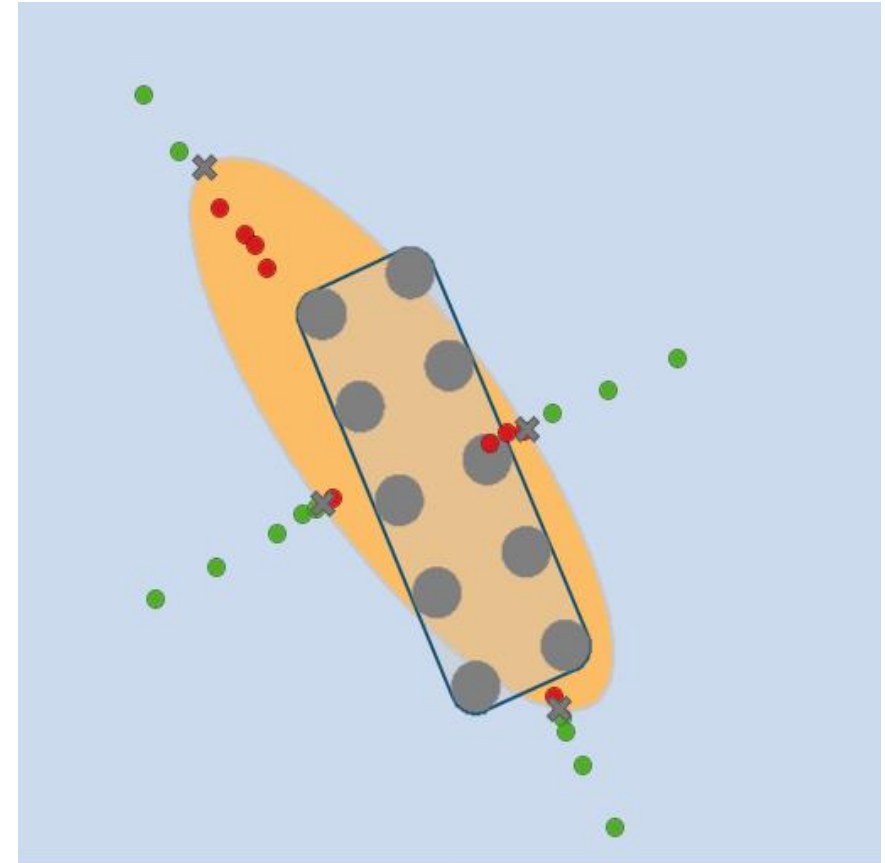
2. Determine for each transect a distance at which IQI breaches 0.64



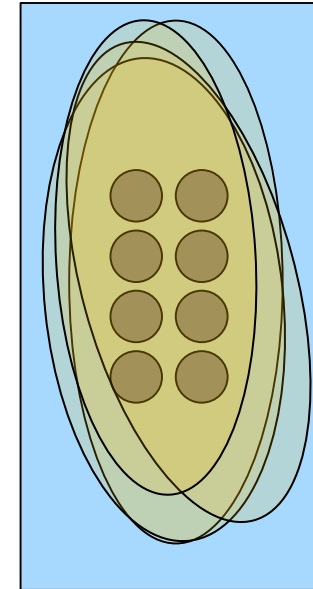
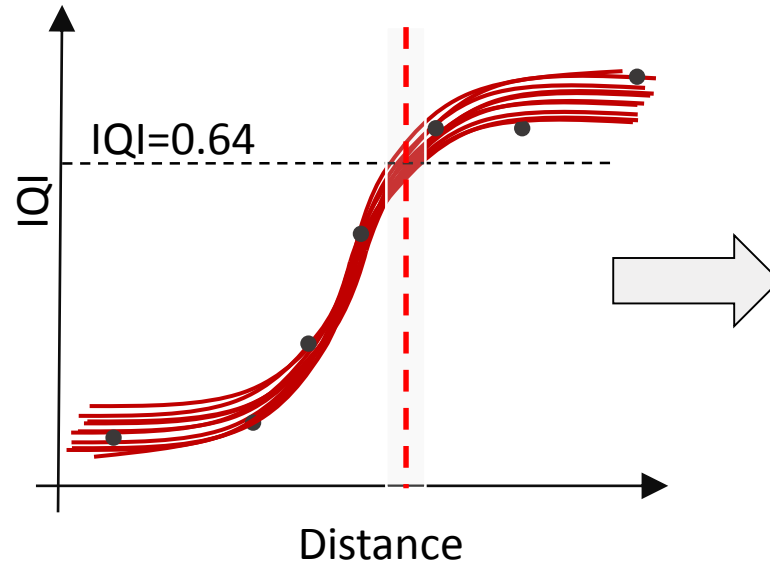
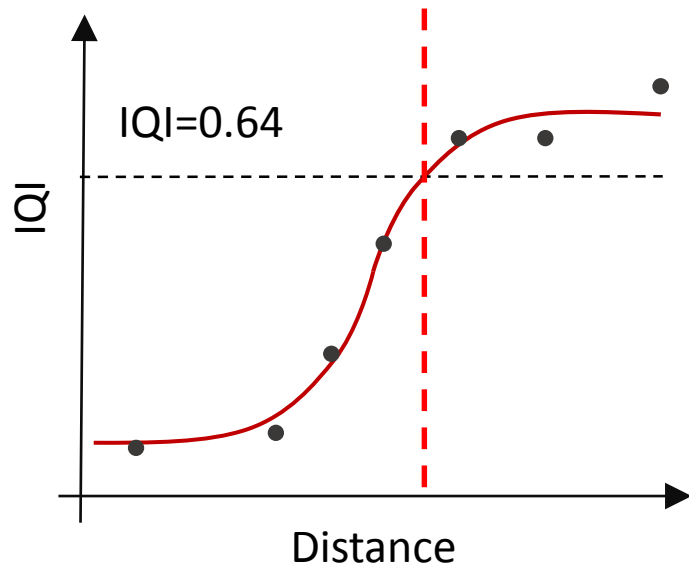
Area standards – compliance method (spanning ellipse)

1. Sample sufficient transects & sampling points around the fish farm
2. Determine for each transect a distance at which IQI breaches 0.64
3. **Use a spanning ellipse anchored by the above breach distances to determine the area impacted**

Ellipse area \leq Allowed area

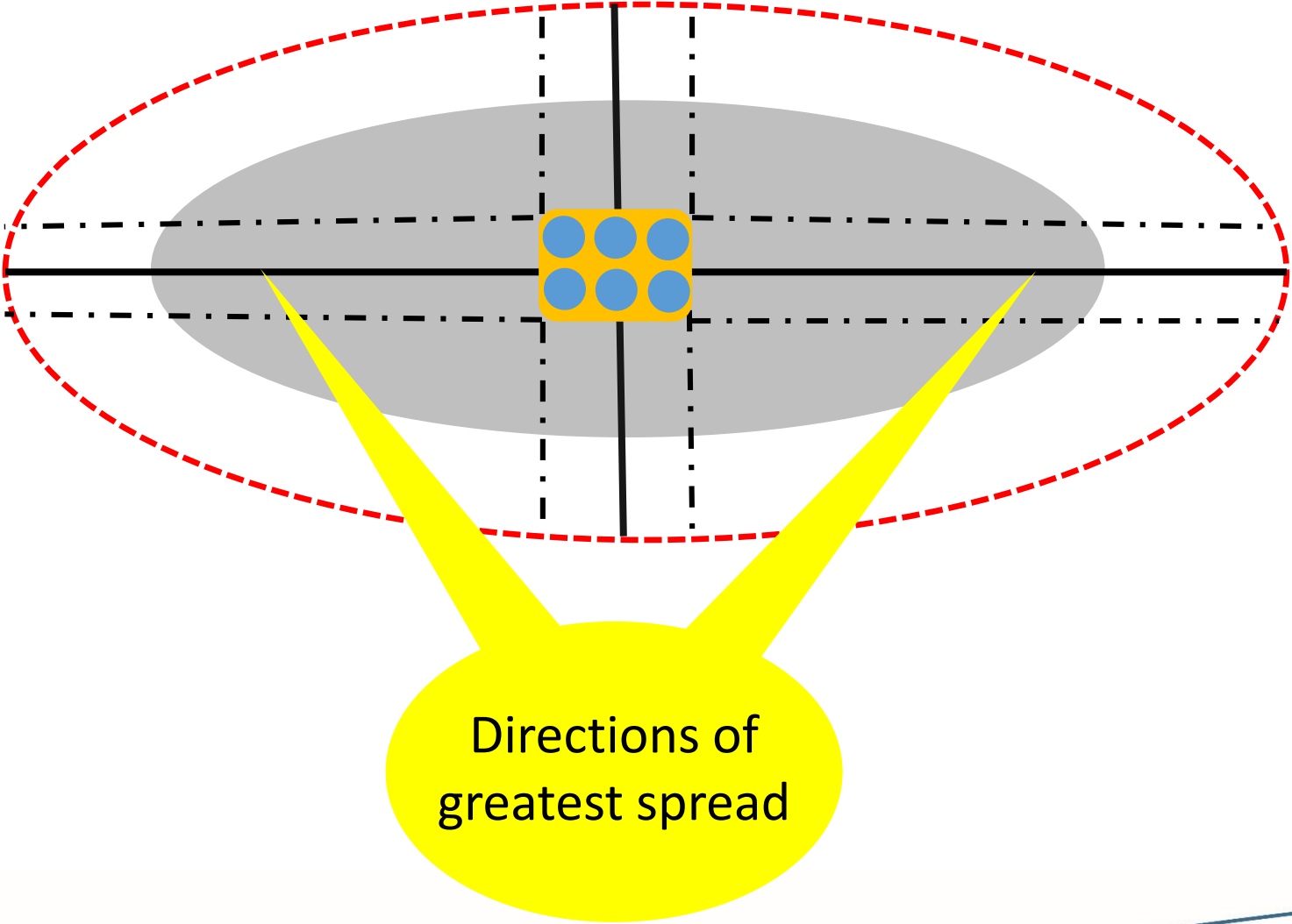


Area standards – uncertainty in impacted area



- **We only want to designate farms as non-compliant where we have a high degree of confidence regarding this**
- This maintains consistency with other industries SEPA regulates ($\geq 95\%$ confidence for non-compliance)

Where : Transect design

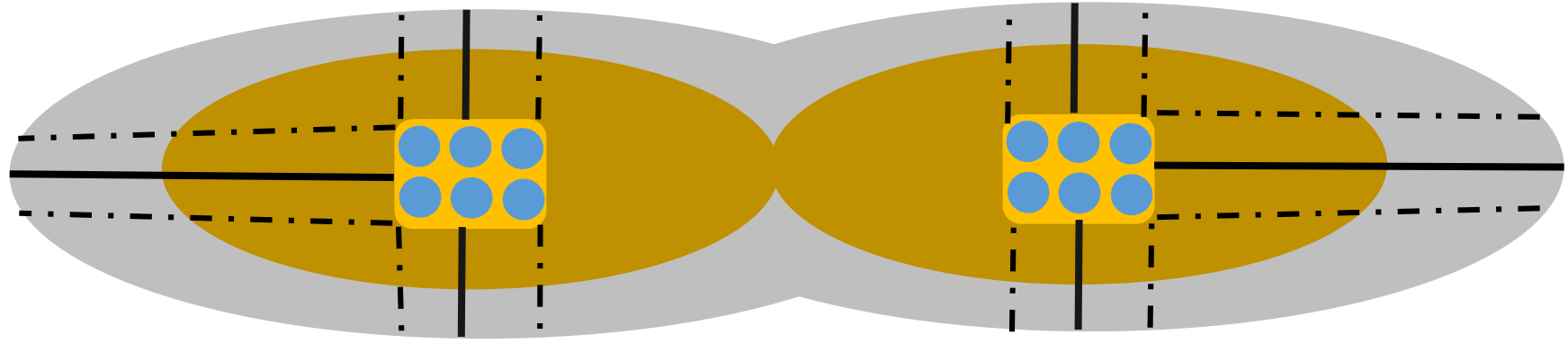


Broadly orthogonal pattern

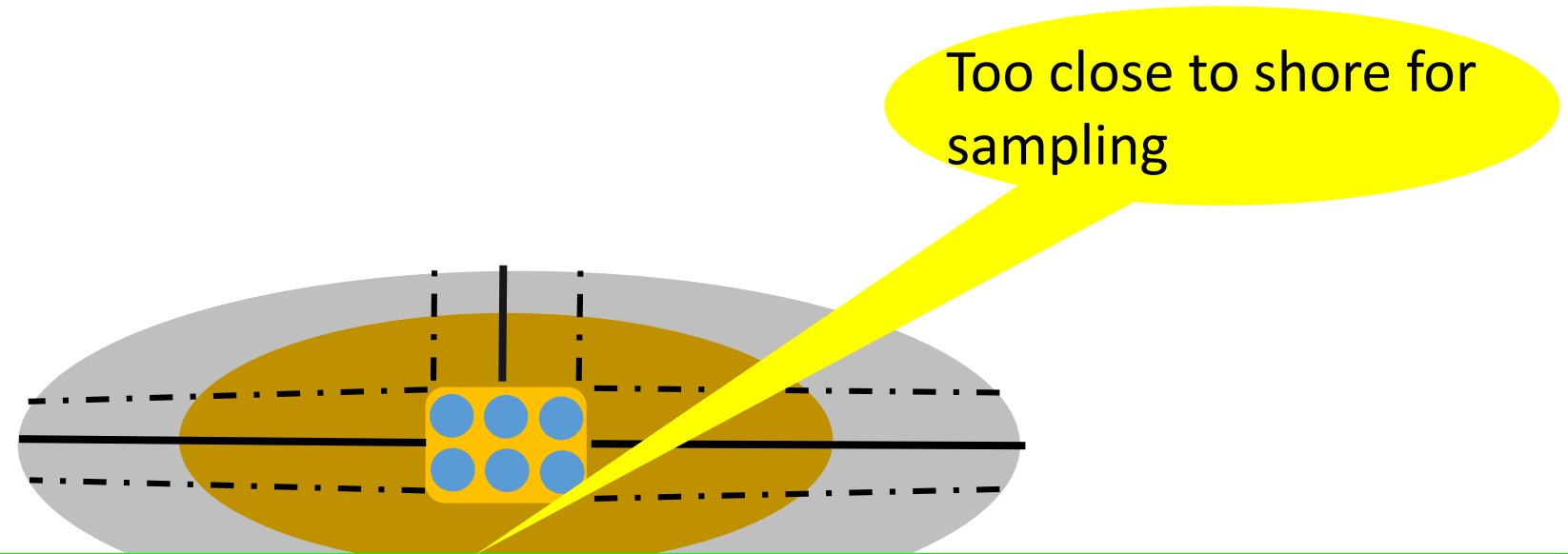
Minimum of 4 transects*

Directions of greatest spread

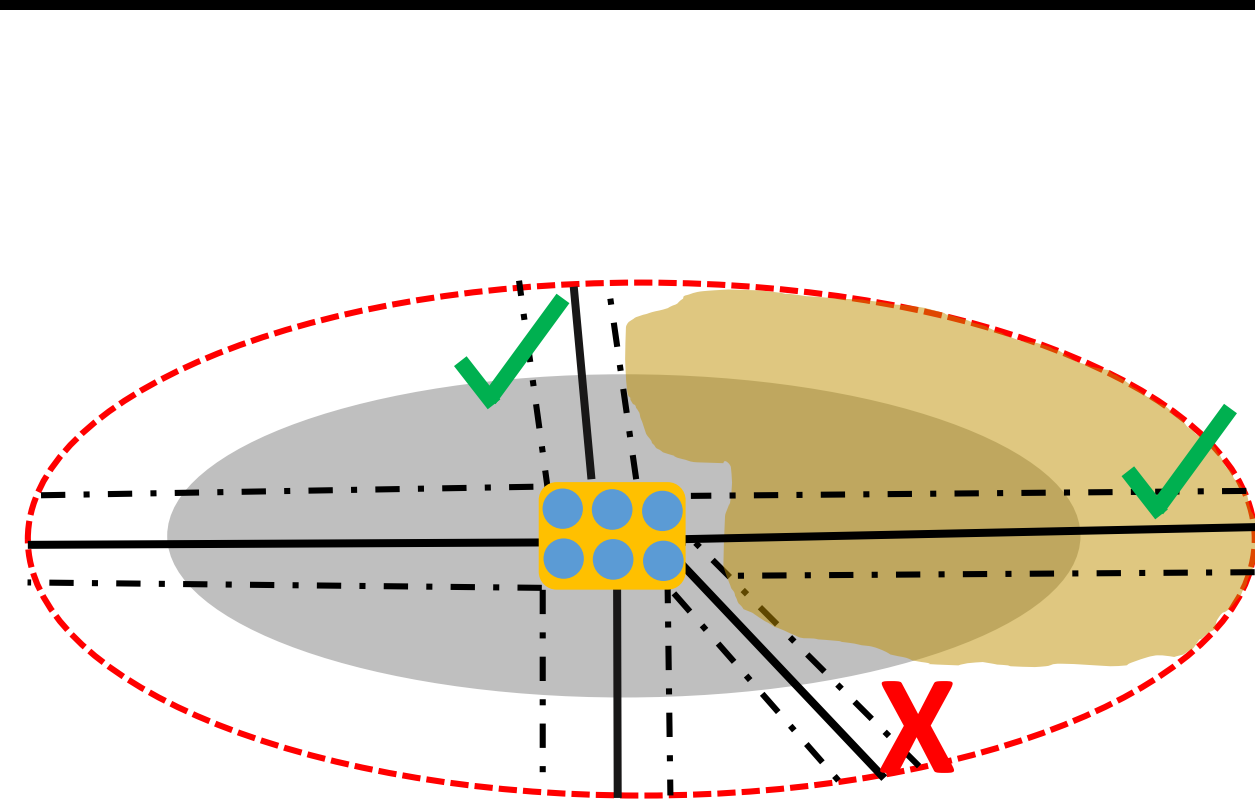
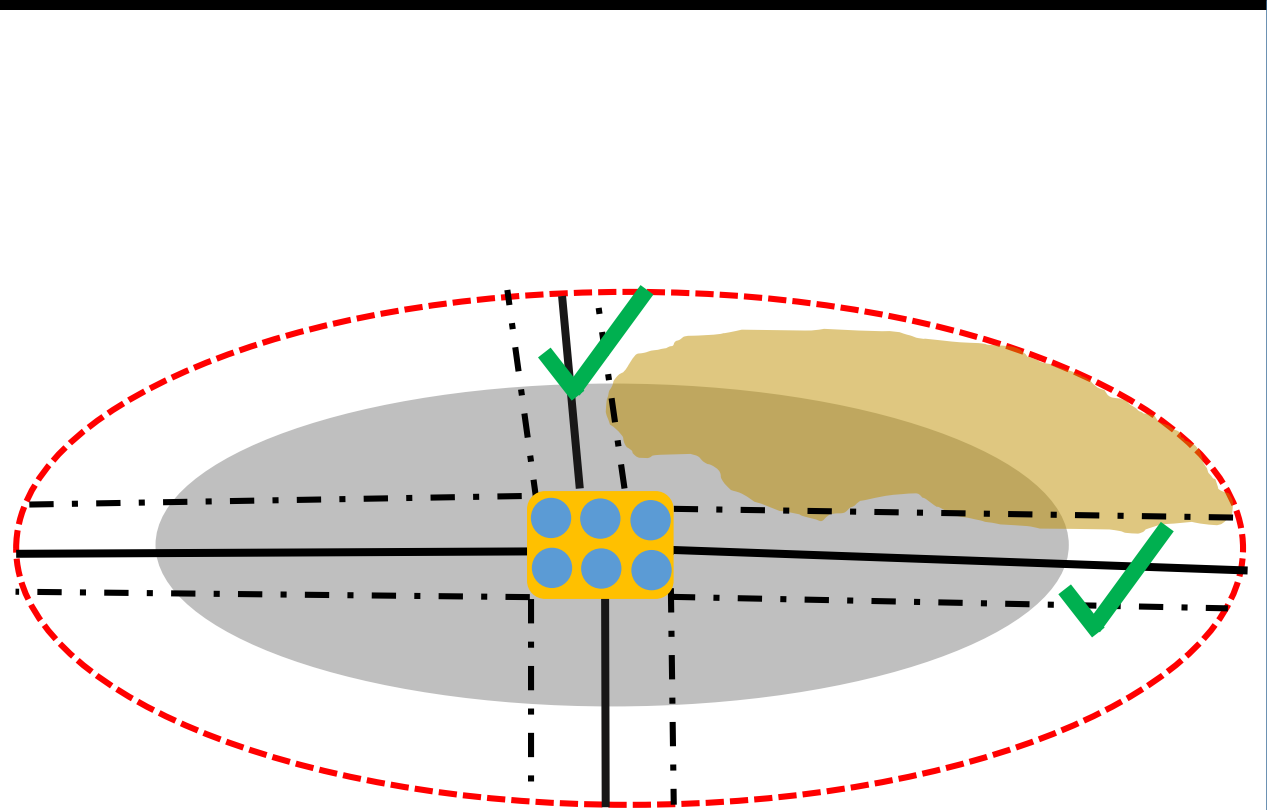
Transects & two cage groups



Three transects



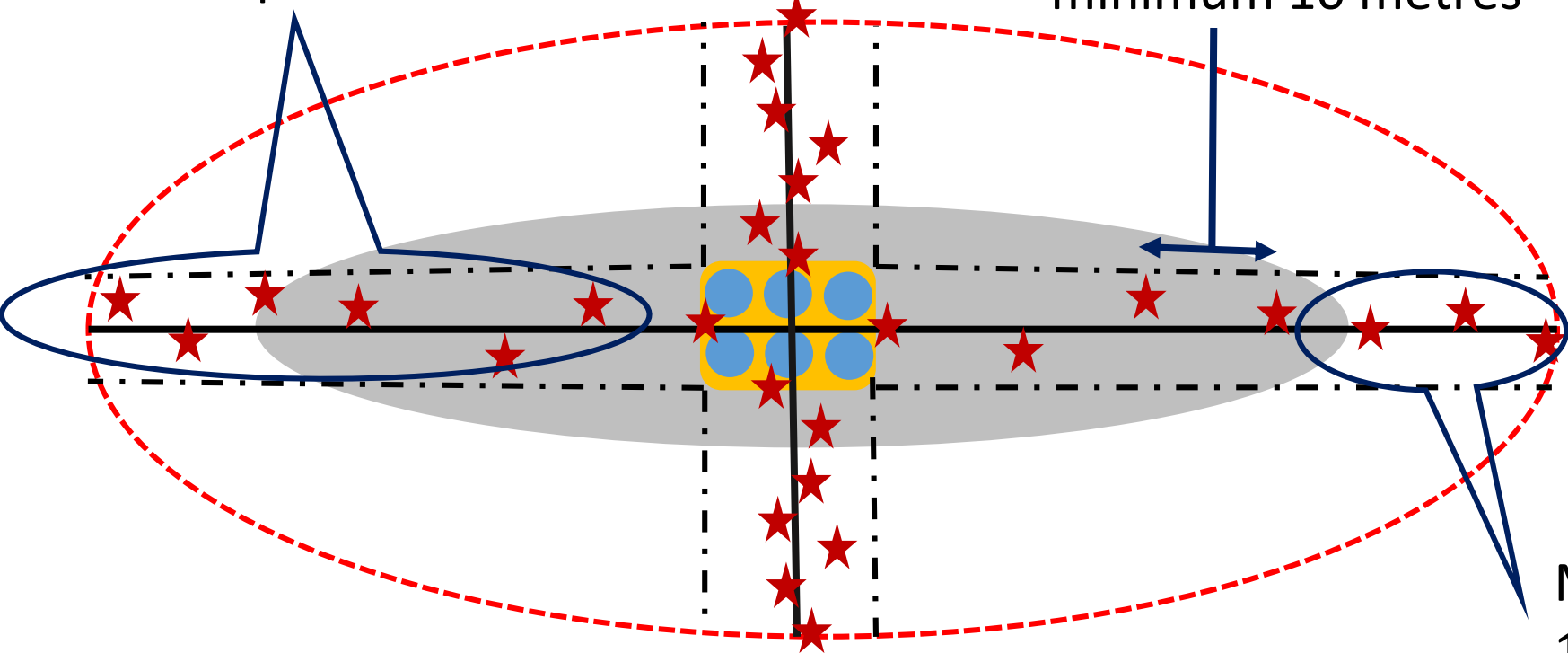
Minimising hard substrate sampling



1st & 2nd cycle sampling stations

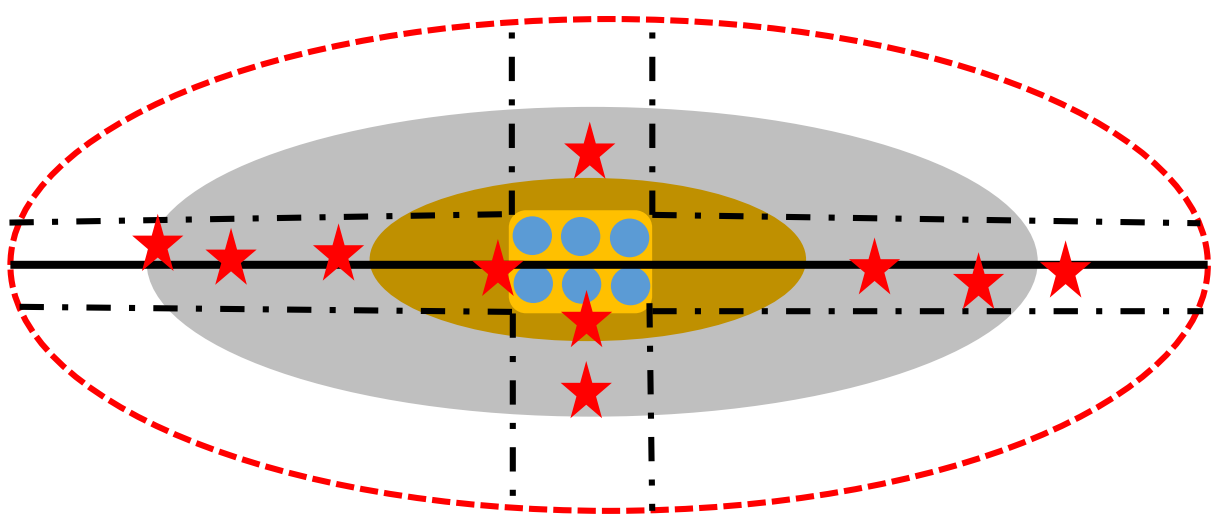
Cage edge + minimum of 6 stations per transect

Optimum 25 metres
minimum 10 metres

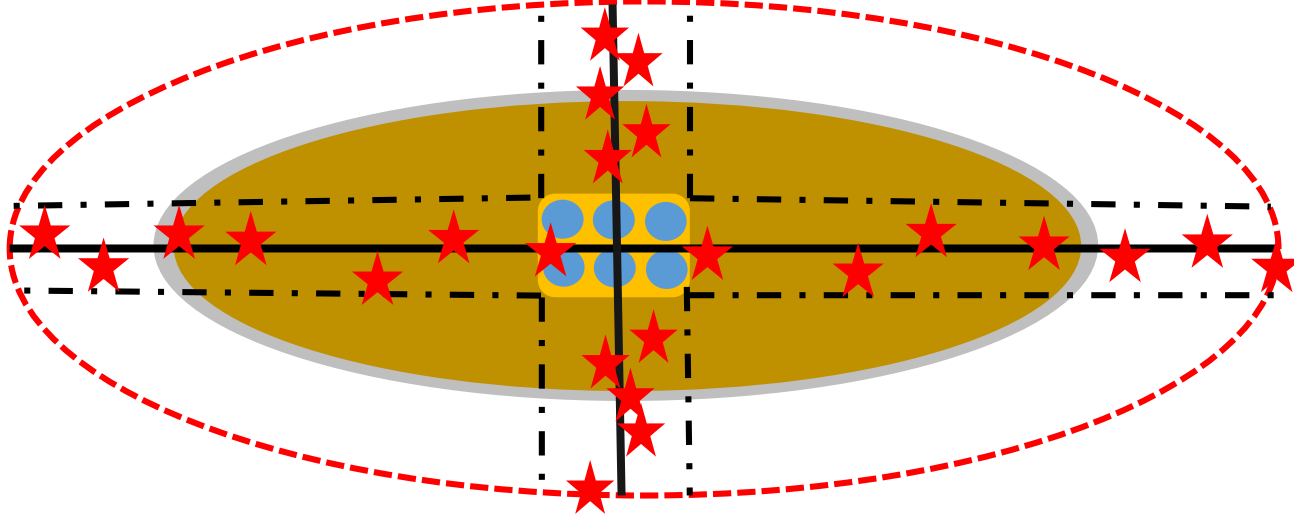


Minimum of 1 station around
100 metre mixing zone edge
+ 2 beyond

Where to sample: 3rd cycle onwards

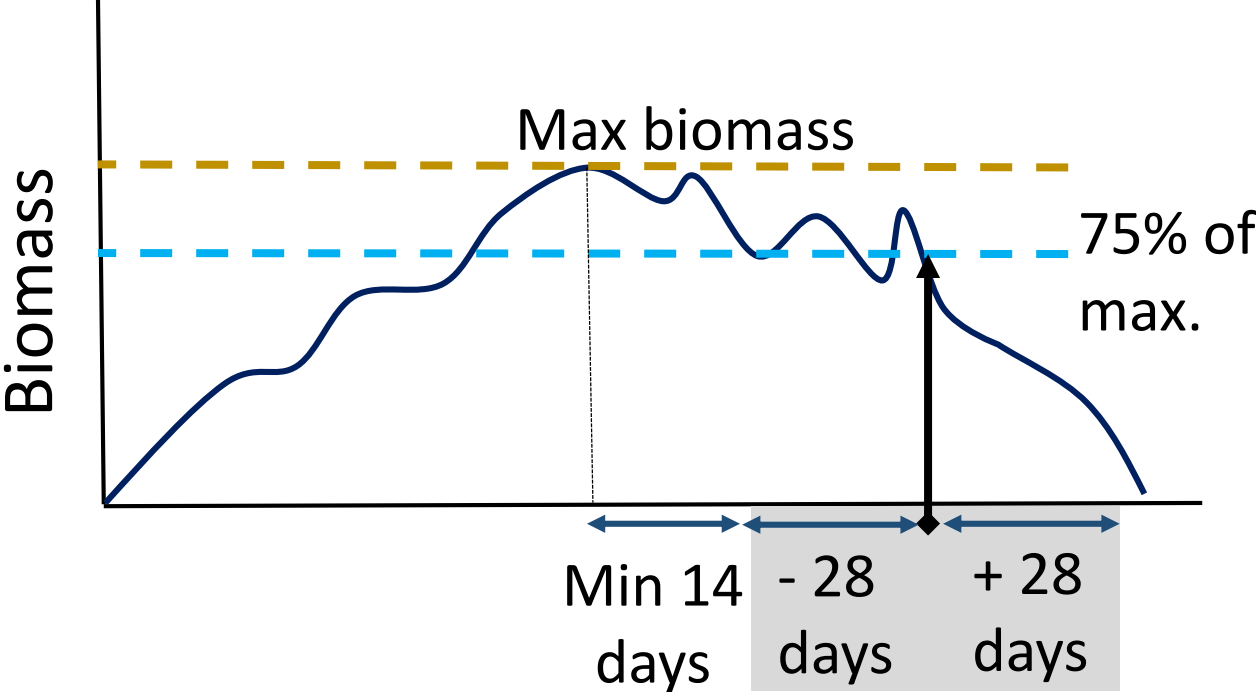
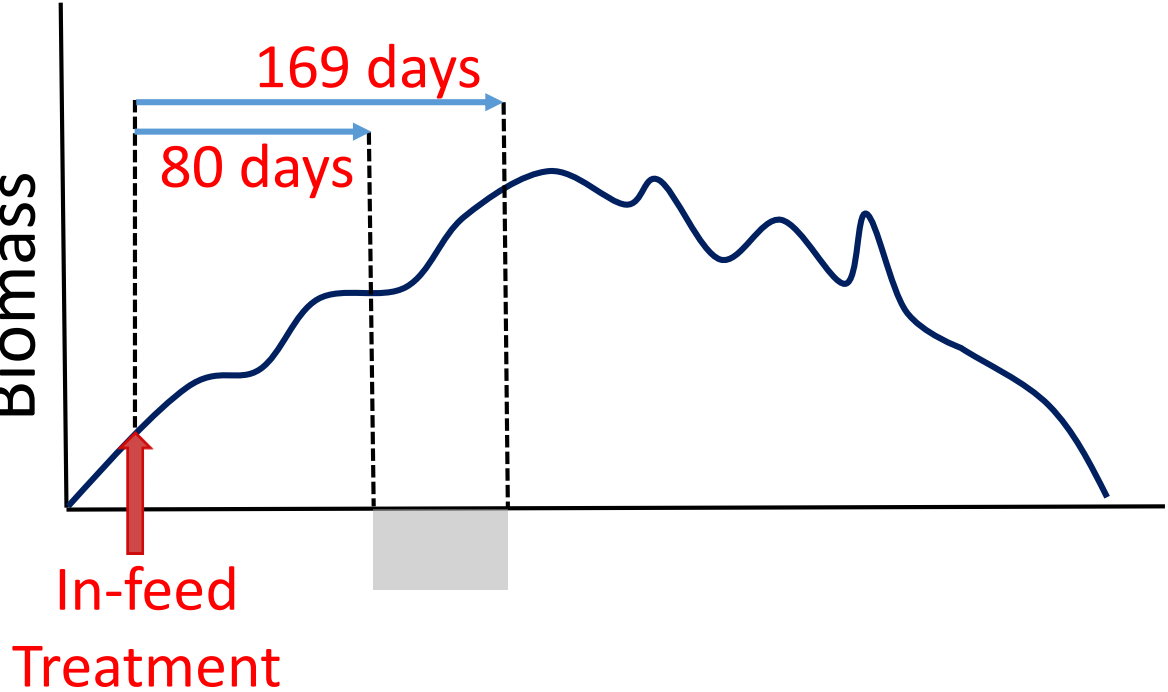


Comfortably meeting standards in 1st & 2nd cycles



Operating close to limit 1st & 2nd cycles

When to sample



Initial check of medicine compliance

Near end of cycle – check of overall performance

QUESTIONS