AI AND DRONES FOR SEAL MONITORING

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GREY SEAL
(*Halichoerus grypus*)

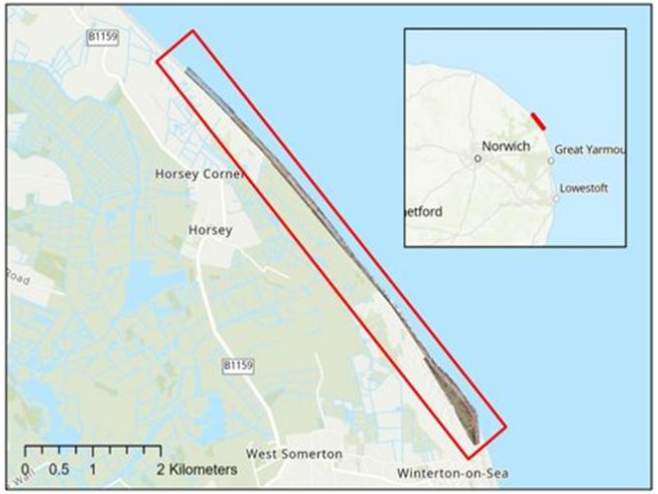
35% of the world's grey seals breed on UK coasts.

Grey seal WERE in decline:
Only 500 in the UK at the beginning of the 20th century

But today the population has increased to over 162,000 across the UK.

Horsey to Winterton in Norfolk is an important breeding area for grey seals.

Protected species.



GROUND COUNTS

- 10 volunteers
- 8 hrs
- Difficult visibility

AIMS & OBJECTIVES

1

Identify suitable deep learning architecture to detect pups and adults.

2

Detect and provide counts for seal pups and adults in the drone imagery.

3

Validation

Compare results with ground counts.

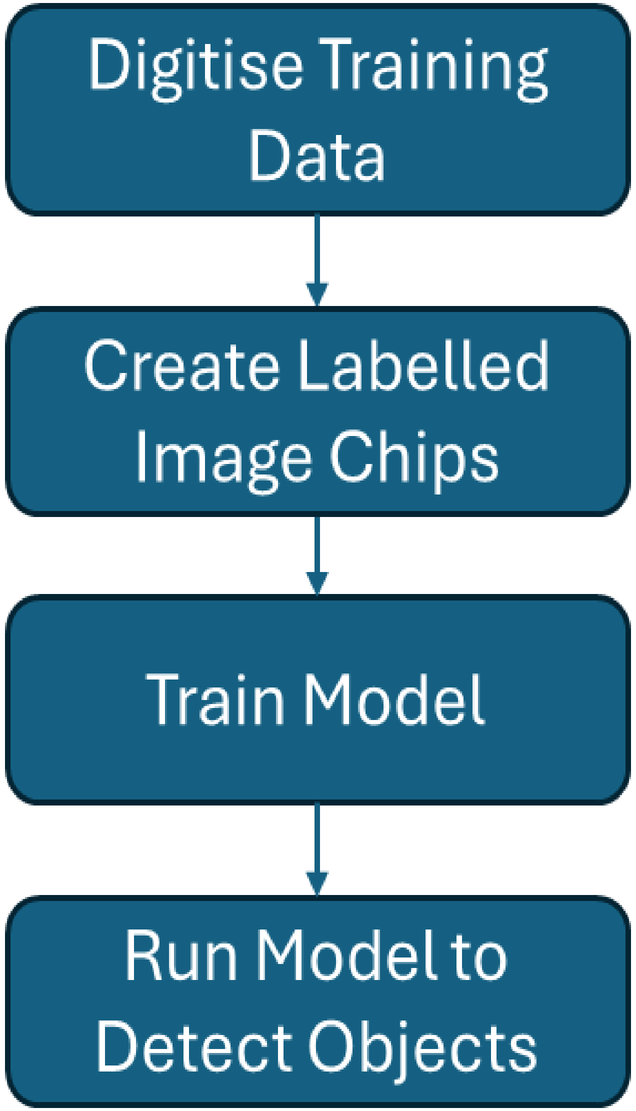
4

Next Steps - Carry out future drone surveys and apply the model.

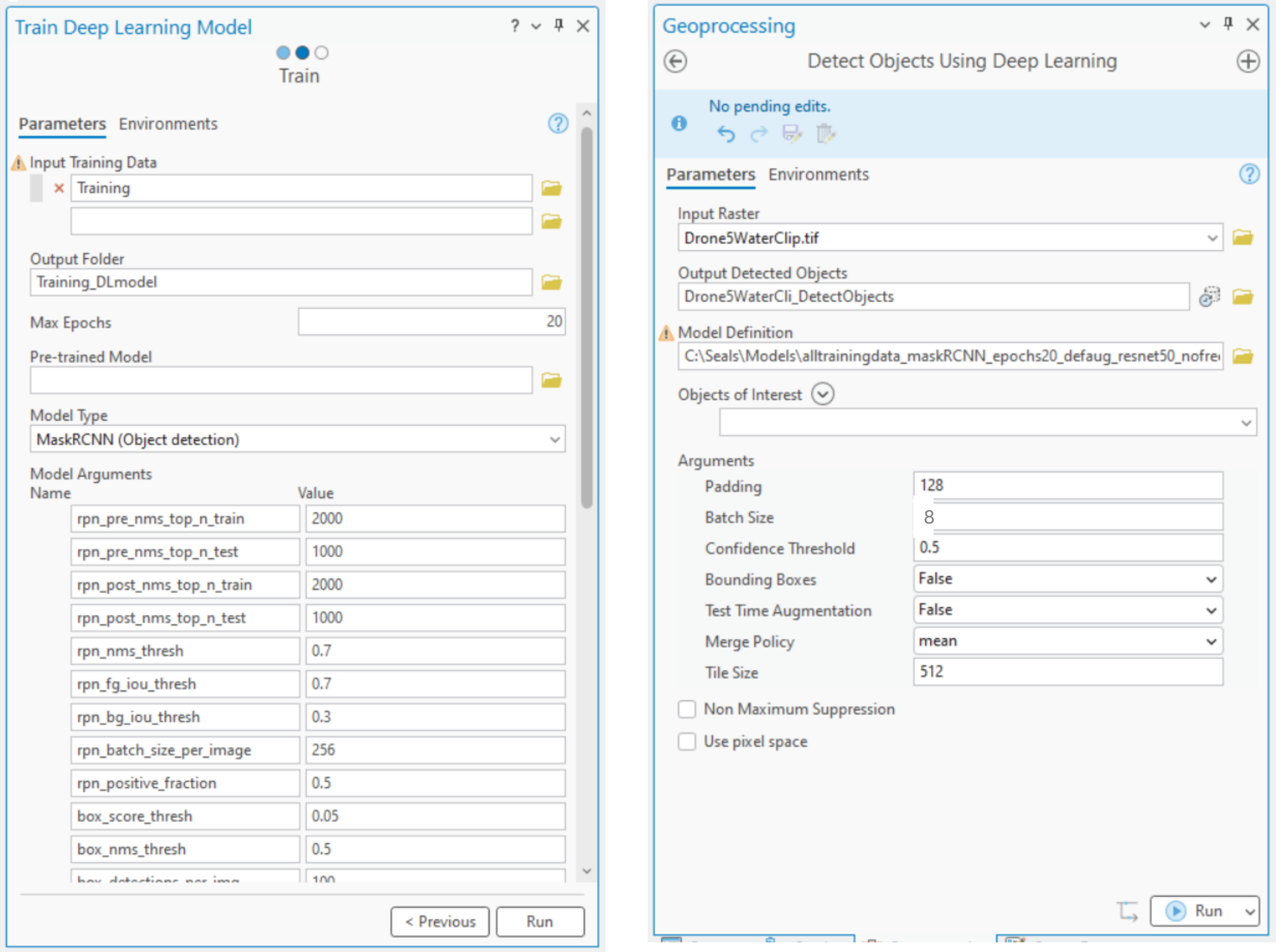
DRONE SURVEY

- WINTERTON – HORSEY, 8KM
- DJI MATRICE 300, RGB SENSOR
- 110M ALTITUDE, 12M/S
- 1.38CMS/PIXEL

B1159
Horsey Corner
Horsey
Road
B1159
West Somerton
Winterton-on-Sea
0 0.5 1 2 Kilometers
Norwich
Great Yarmou
Lowestoft
etford

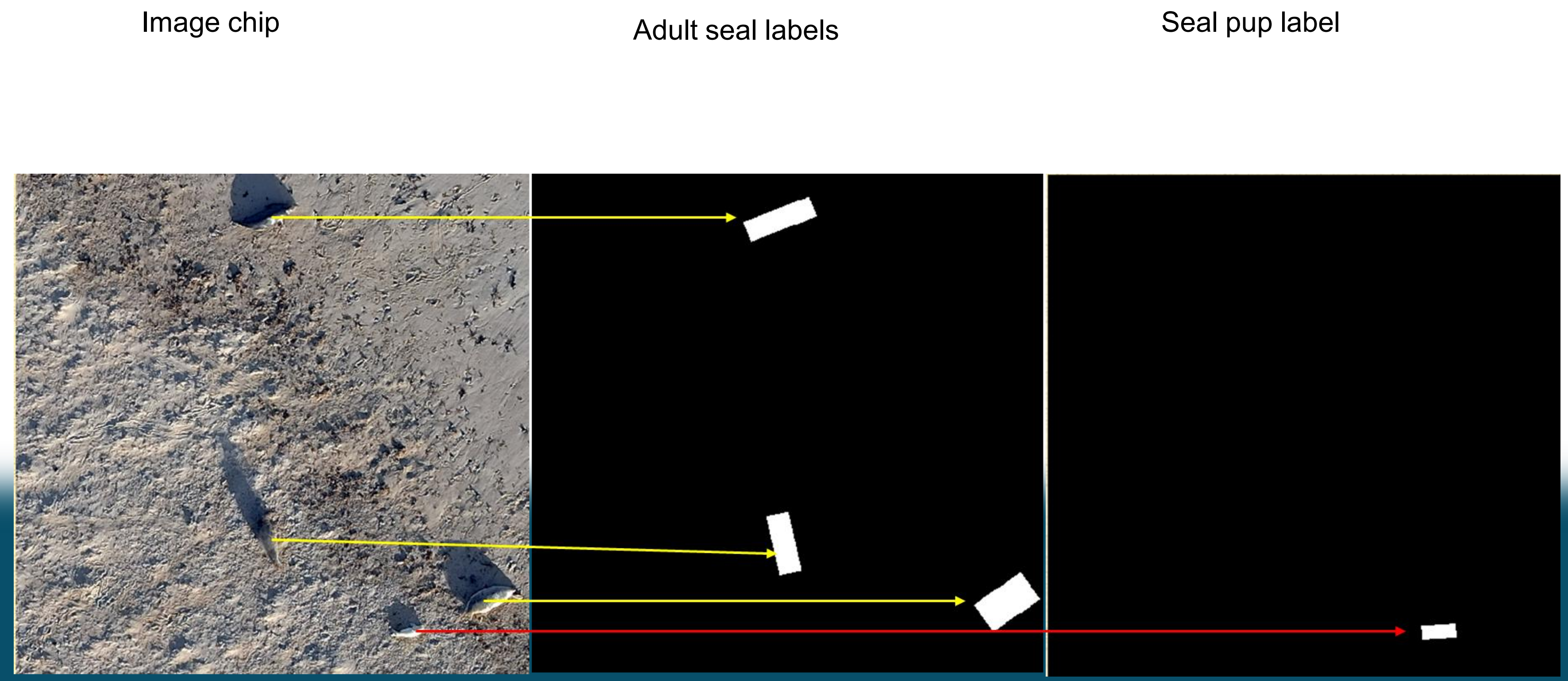


Overview of the deep learning workflow.



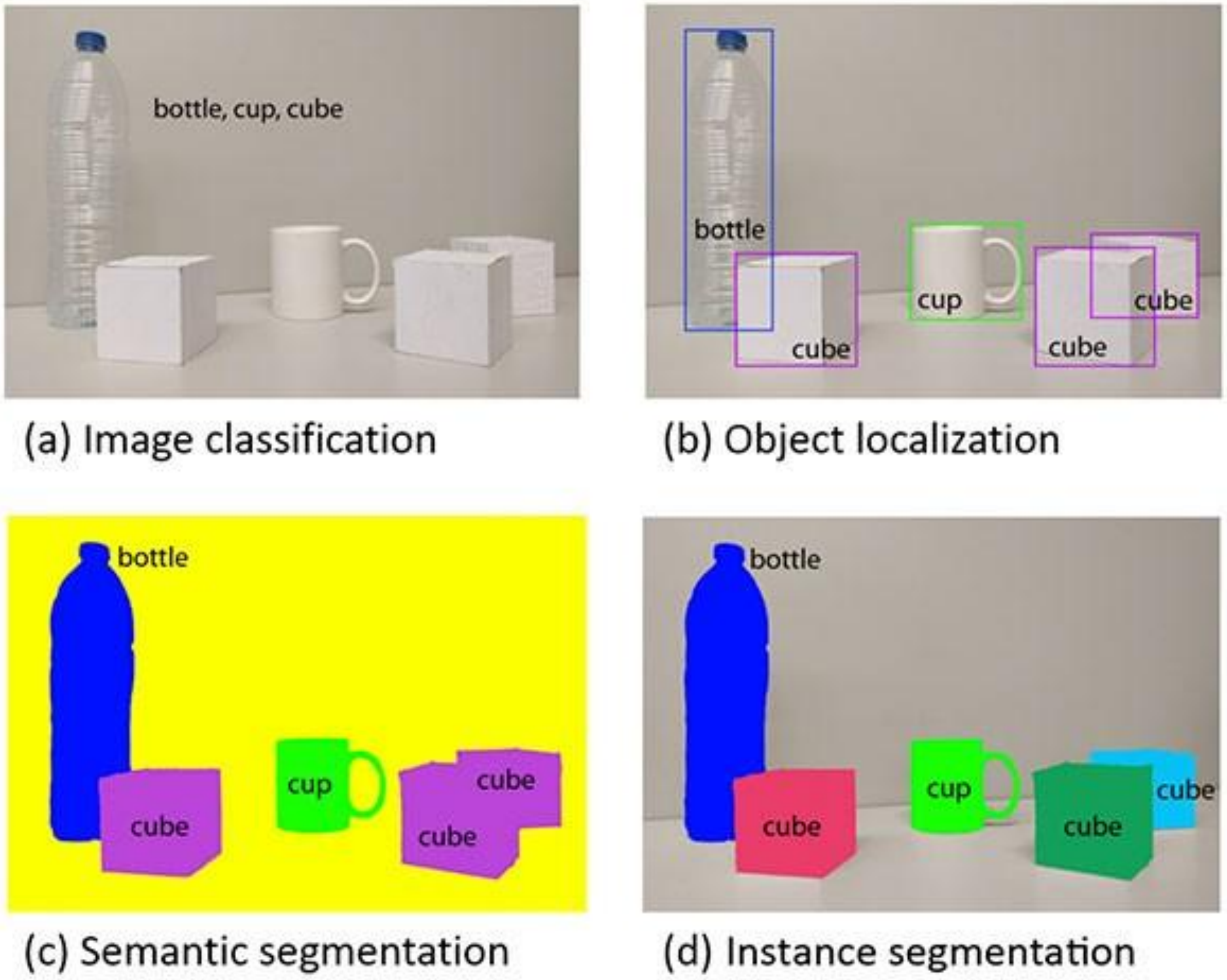
TRAINING DATA

- 2 of 8 images selected
- Bounding boxes
- Labelled adults and pups
- 2400



Example of an image chip and labels.

Inferencing techniques



(a) Image classification
(b) Object localization
(c) Semantic segmentation
(d) Instance segmentation

MaskRCNN ResNet-50

RESULTS

RESULTS

VALIDATION (1 of 8 images)

IoU >=0.5	Precision	Recall	F1 Score	AP	True Positive	False Positive	False Negative
All Classes	0.956	0.985	0.970	0.956	1155	53	18
Adults	0.958	0.975	0.966	0.946	574	25	15
Pups	0.954	0.99	0.974	0.966	581	28	3

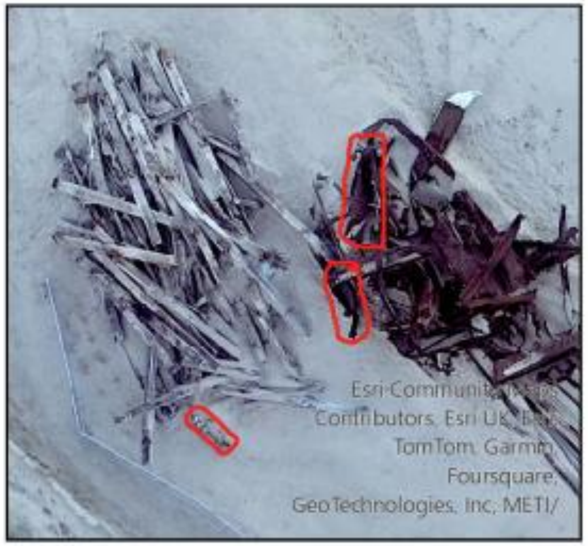
IoU >=0.75	Precision	Recall	F1 Score	AP	True Positive	False Positive	False Negative
All Classes	0.908	0.935	0.922	0.862	1097	111	76
Adults	0.895	0.910	0.902	0.823	536	63	53
Pups	0.921	0.961	0.941	0.901	561	48	23

INCORRECT DETECTIONS

Wall to wall visual checks of all images (8506 detections)

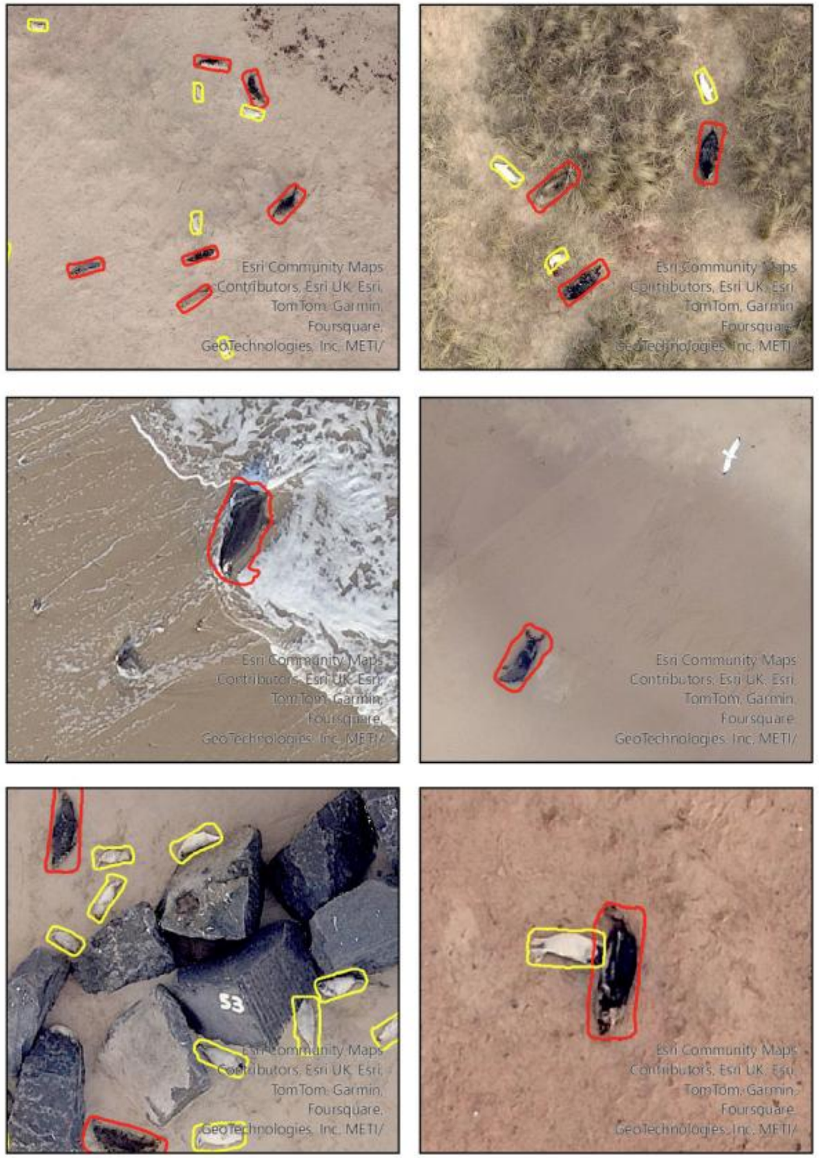
37 false negatives

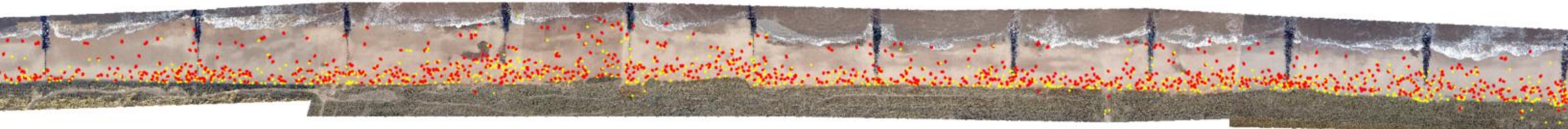
396 false positives



RESULTS

Method	Adult Seal Count	Seal Pup Count	Total Count
Drone/AI	4377	4129	8506
Ground Count	3426	2782	6208





CONCLUSIONS

Results indicate that drones and AI are an effective tool

- Large training dataset
- Homogenous sandy beach

Method	Advantages	Disadvantages
Ground-based counts	• Increase public ownership • Frequent monitoring • Richer data (etc body condition)	• Limited visibility, difficult to access some areas • Observer bias/counting errors
Drone and AI surveys	• Can access remote/inaccessible areas • Scalable and repeatable across other areas • At this site, better count data	• Weather limitations • More expensive equipment and training needed • Requires special permissions and careful planning

ADDITIONAL APPLICATIONS