한강하구에서 비닐쓰레기의 조시별, 수층별 분포 특성

Chung-Koo Zhang[1], Seung-Buhm Woo[1,*] Byung-il Yoon[2], Yoon-sung Jung[3]
[1] 인하대학교 해양과학과 [2] 인하대학교 인천경기충남씨그렌트센터 [3] 인하대학교 해양AI융합센터 // E-mail: namukkun33@gmail/com, sbwoo@inha.ac.kr*

1 연구배경 및 목적 : 수중비닐쓰레기 심각

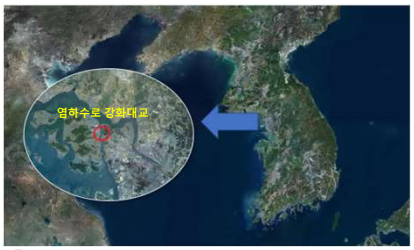


Figure 1. The Han River Estuary, where the Han, Imjin, and Yesong Rivers discharge into the Yellow Sea, was selected as the study area. Sampling of submerged plastic film debris was conducted in front of Deorimi Port, beneath Ganghwa Bridge, in the Han River Estuary.

➔한강하구(강화도 동측)
수중 비닐 쓰레기 누적 심각

➔ 분포 특성 및 원인 파악 미흡

2 연구방법 : 수중쓰레기 수집 및 분석

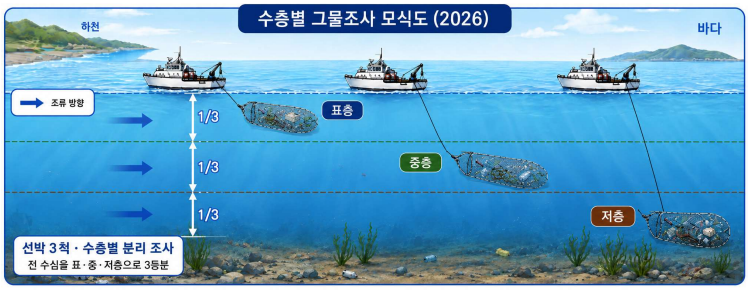


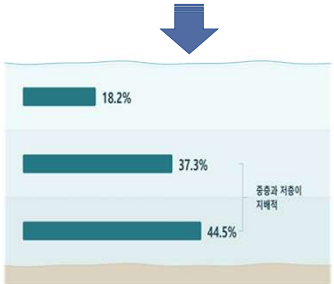




Figure 2. Plastic film debris collected using nets was separated from aquatic organisms, including shrimp and fish, using an electrically powered sorting device (b) and manual sorting. The sorting device consisted of an electrically driven mechanical system and a fan (a).

3 연구결과 : 수층별 조시별 수중쓰레기 무게





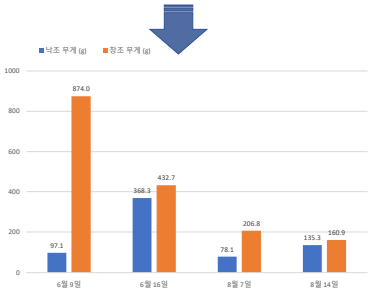


Figure 3. A total of 81.8% of the submerged plastic film debris by weight was found in the middle and bottom layers of the water column. Furthermore, higher amounts of submerged plastic film debris were observed during flood tides than during ebb tides on all four sampling days.

4 원인분석 : 퇴적물 흡착 영향 (2026년 8월)

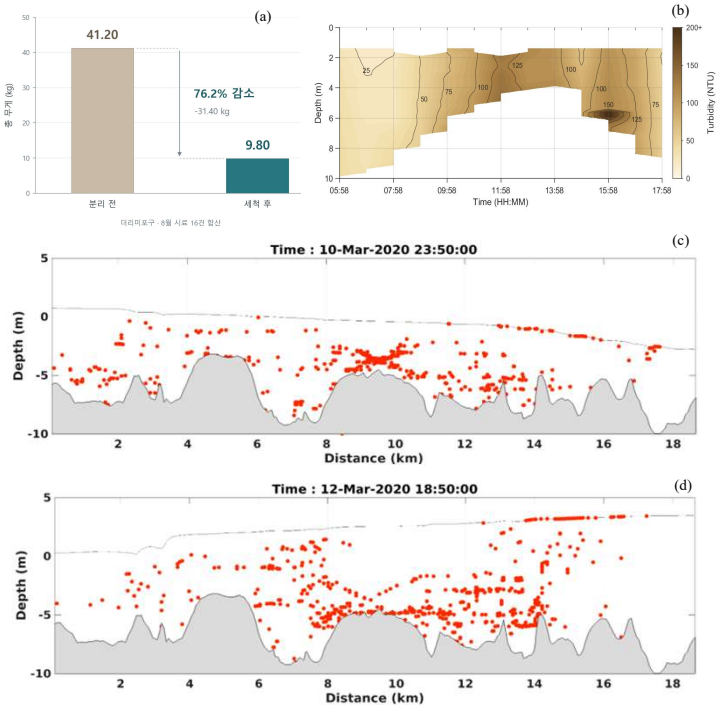


Figure 4. The Han River Estuary is characterized by high suspended sediment concentrations (b), resulting in substantial differences in the weight of collected plastic debris before and after washing (a). Particle tracking simulations incorporating particle density also revealed that the particles tended to remain in the middle and bottom layers of the water column without being resuspended (c and d).

5 원인분석 : 쓰레기 분포에 대한 성층 영향

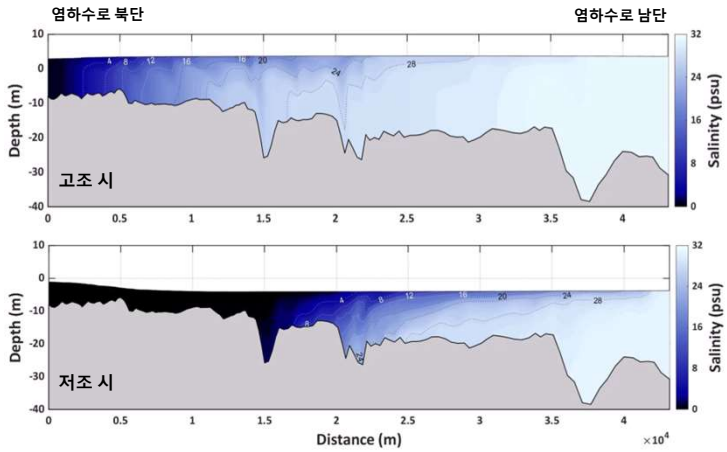


Figure 5. These findings are likely attributable to the combined effects of the complex hydrodynamic conditions in the Han River Estuary and the physical properties of plastic film debris. In particular, given the pronounced tidal variations in vertical salinity gradients, the possibility that density stratification between water masses may suppress the resuspension of plastic film debris cannot be ruled out.

6 요약 및 제언

- 한강하구 수중비닐쓰레기는 표층보다는 중층과 저층에 높은 비율로 존재하는 것이 확인되었다.
- 낙조 후기보다 낙조 초기에 그리고 낙조 보다 창조 시에 상대적으로 많은 쓰레기가 관측되었다.
- 한강하구의 비닐쓰레기가 단순히 표층을 따라 부유하지 않고 강한 조석, 담수 유입, 수직 밀도 구조 및 입자 특성의 영향을 받아 수층별로 다르게 분포할 수 있음을 보여준다.
- 이번 연구결과는 하구지역에서의 쓰레기 수거 방식과 시기 등 하천유입 해양쓰레기 정책수립의 기초 자료로 활용될 수 있을 것이다.

. 이 논문은 2026년도 해양수산부 재원으로 해양수산과학기술진흥원의 지원을 받아 수행된 연구임(RS-2026-25538840, 인천·경기·충청씨그랜트)