EXPERT REPORT: PIERCE COUNTY LONGBRANCH GEODUCK FARM HEARING:

WITNESS: DAN PENTTILA, SALISH SEA BIOLOGICAL, ANACORTES, WA.

RESUME/BACKGROUND:

Birth: Born 5/22/48, in Portland, Oregon.

Education: Mt. Vernon Union High School, Mt. Vernon, WA, graduated 1966.
University of Washington, Seattle, WA, BS, with distinction, in Zoology, 1970, cum laude.
University of Oregon, Eugene, OR, MS in Biology, 1971.

Employment History:

12/71-3/72: Sci. Tech. 2 (temp.) WA Dept. of Fisheries (WDF), Columbia R. Lab, Vanc., WA
4/72-1973: Sci Tech. 2 (perm.), WDF Puget Sd. Baitfish Project. Seattle, WA
1973-1979: Fish Biologist 2, WDF, Puget Sd. Baitfish Unit, Seattle, WA
1979-1985: Fish Biologist 3, WDF Forage Fish Unit, Seattle, WA
1985-1990: Fish Biol. 3, WDF Marine Habitat Investigations Unit, Seattle, WA.
1990-2004: Fish Biol. 3, WDF/WDFW Forage Fish Unit, Mt. Vernon/LaConner, WA.
2004-2005: Habitat Biol. 3, WDFW Region 4 PHS/GMA Biol., LaConner, WA
2005-2009: Fish Biol. 3, WDFW Puget Sd. Action Team Forage Fish Proj. LaConner, WA
2009-7/10: Fish Biol. 3, WDFW Puget Sd. Partnership Forage Fish Proj. LaConner, WA.
7/1/10: Retirement from WDFW, after 38.5 years of service.
7/10-present: Operates "Salish Sea Biological" (licensed sole proprietorship), Anacortes, WA, specializing in forage fish-related consultation activities.

Experience:

University educational experience specialized in marine intertidal biology and ecology. UO MS critical essay involved the exotic marine mollusks of the Pacific Northwest.

WDF/WDFW work duties included the first-ever detailed herring spawning habitat mapping surveys conducted in Washington State, including the identification of herring spawning substrates plants, aging of herring eggs by embryological stages, and the preparation of daily field survey reports and charts.

Work duties included the first-ever large-scale plankton-sampling surveys ever conducted inside Puget Sound for the purposes of mapping the distribution of herring and other forage fish larvae, including the collection and analyses of several thousand plankton samples, sorting, identification, counting and measuring of forage fish larvae, and identification of other categories of planktonic organisms.

Work duties included participation in first-ever hydro-acoustic/mid-water trawl herring assessment surveys ever conducted in Puget Sound, including the collection and analysis of herring biological samples.

Work duties included organization and conduction of the first-ever wide-ranging surface-trawl sampling surveys throughout the inner Puget Sound basin, 1975-1985, involving the night-time deployment of 2000+ surface trawl sets near-shore, sorting and identification of trawl catches, collection of biological data from preserved sub-samples of herring and other forge fish species., and the preparation of annual project reports

Work duties included the first-ever wide-ranging surveys to map surf smelt spawning beaches in the Puget Sound basin, involving opportunistic survey effort 1972-1985, initially based on the only previous such mapping work undertaken in Puget Sound in the 1930s.

In late 1989, work activities included the first-ever discovery of the spawning habitat of the Pacific sand lance, another important but little-known forage fish species, on upper intertidal sand-gravel beaches in the Puget Sound basin. From that time to the present, all beach habitat surveys have included sampling for both surf smelt and sand lance spawning sites.

Synoptic surveys of all suitable-looking upper intertidal sand-gravel beaches in the greater Puget Sound basin commenced during the WDF Intertidal Baitfish Spawning Beach Survey Project (IBSBSP) during 1991-1997. This included the development of standardized spawning beach sampling survey protocols, the collection and analyses of about 1,200 individual beach substrate samples annually, and the production of periodic reports summarizing new findings.

The surf smelt/sand lance spawning habitat survey work continued under interlocal agreements between WDF/WDFW and local county Marine Resources Committees (MRCs) in the northern area covered by the Northwest Straits Commission during 2000-2004. Interlocal agreements with Thurston and Mason Counties supported additional forage fish spawning beach surveys in those areas during 2003-2004.

During 2005-2007, additional exploratory surf smelt/sand lance spawning habitat-mapping surveys were supported by the Puget Sound Action Team Forage Fish Project. During the 2009-2010 periods, surf smelt/sand lance spawning beach investigations were conducted the auspices of the Puget Sound Partnership Forage Fish Project.

Surf smelt/sand lance spawning habitat survey activities during the 2000-2004 period also included in the training of additional WDFW surveys teams and several NGOs (Friends of the San Juans, North Olympic Salmon Coalition) in the survey protocols, other assistance and lab QA/QC as these groups conducted surf smelt/sand lance spawning beach surveys in Clallam, E. Jefferson, and San Juan Counties.

From about 2005 to present, work activities have included consultations and field/lab assistance in smelt/sand lance spawning habitat survey projects in British Columbia under the auspices of the non-profit British Columbia Shore Spawners Alliance (BCSSA). This has included community forage fish workshops, processing and QA/QC of lab samples.

Work activities from about 1995 to 2010 included the frequent preparation and delivery of forage fish-related informational workshops for the public, shoreline stewardship groups, school classes, Indian Tribes and state and federal natural resource agency staff. These commonly included an oral slide presentation summarizing the spawning ecology of the various local forage fish species, poster/chart displays, a microscope lab session for inspection of eggs and larvae, sets of hard-copy informational handouts, and a low-tide field trip to a nearby forage fish spawning beach. Roughly 10-12 such workshops would be presented annually.

Work duties from 2002-2010 included annual smelt/sand lance spawning habitat survey protocol "certification"/training classes held for consultants, land-use managers, and agency staff. These full-day classes included all the informational aspects of the public workshops, plus more specific field and lab training for the assessment of spawning habitats, collection and processing of beach sediment samples, and microscope lab processing of samples for the extraction add identification of forage fish eggs. Thus consultants would be trained for site -specific sampling of beaches during the course of HPA applications. About 200 people went through this more comprehensive training during the 2002-2010 periods.

Work duties commonly included contributions to the development of both in-house policies and WAC Hydraulic Code regulations for the protection and conservation of forage fish spawning habitats in Washington Sate. These began in the 1970s for surf smelt and herring spawning areas after it became apparent that existing policies and regulations did not sufficiently protect known spawning areas from net-

loss destruction. In the 1980s, the WAC Hydraulic Code was modified to include language for the protection of herring and surf smelt spawning areas, and definition of work-closure periods during local herring and surf smelt spawning seasons by Tidal Reference Areas through the state's marine waters. In the 190s, the Hydraulic code was further modified to include protective language for Pacific sand lance spawning beaches, once surveys confirmed that these were widespread throughout the Puget Sound basin. Improving forage fish spawning beach survey coverage over time and space led to additional modifications of permissible in-water work windows for forage fish spawning beaches by Tidal Reference Area.

Work activities frequently included consultations with WDF/WDFW marine area habitat biologists in the application of the evolving forage fish spawning habitat database to Hydraulic Permit Applications for in-water development activities along the shorelines of the state. These involved a number of activities from site visits to assess habitats or collect samples for determination of the presence of eggs, to written/phone/e-mail comments, on request, derived from the forage fish database pertaining to project location, design and work-timing. On several occasions, agency involvement in HPA appeals led to the preparation and delivery of sworn expert testimony before administrative law judges and the State Shoreline Hearings Board on the state's and resource's behalf on matters pertinent to the documentation, protection and conservation of forage fish spawning habitats at specific contentious project sites.

From April 2004 through June 2005, new work duties centered on the review and drafting of agency comment letters during the updating of Critical Area Ordinances (CAOs) for various county and city jurisdictions within WDFW Region 4 in northern Puget Sound. The state Growth Management Act (GMA) required that jurisdictions give appropriate attention to the documentation and conservation of "fish and wildlife habitat conservation areas" within the language of their growth plans. Work activities included participation in the Whatcom County CAO Technical Advisory Team tasked with discussion and adoption of specific language pertinent to the CAO update through frequent face-to-face meetings of a body of stake-holder representatives.

Work activities commonly included the production of various types of written reports: agency progress reports, manuscript reports, and briefing reports, summarizing work activities, project results, or producing informational handouts for forage fish-related classes and public presentations. Several publications for "refereed" scientific journals and report-series were also produced, as were a number of "conference papers" based on oral presentations delivered before audiences at scientific conferences, for inclusions in the proceedings of those conferences. Several informational posters were also produced for inclusion in the "poster sessions" of such scientific conferences.

DESCRIPTION OF INVESTIGATIONS:

Reviewed exhibits provided by Hendricks:

* Color Map of southern Puget Sound with aquaculture sits marked in red.

* Color map of Longbranch Shellfish aquaculture project site plan/vicinity map.

* 12/1/10: Appellant final witness and exhibit list before Pierce Co. hearing examiner.

* 11/1/10: Applicant's preliminary witness and exhibit list before Pierce Co. hearing examiner.

* 1/12/10: Longbranch Shellfish LLC completed JARPA form for Drayton Pass geoduck farm.

* 5/8/99: C. Simenstad/UW School of Fisheries, letter to R. Teissere/WDNR, reviewing impacts of wild geoduck harvest operations.

* 4/6/05: D. Chaney/Pacific Shellfish Institute memo to P. Prendergast/Pierce Co. Planning reviewing impacts of shellfish culture for Seattle Shellfish proposal.

* 3/28/06: T. Lewis/Pierce Co. Planning memo to Longbranch Shellfish, requiring fish biologist site survey.

* 4/17/06: T. Lewis/Pierce Co. Planning memo to Longbranch Shellfish, clarifying FWHCA review requirements.

* 5/19/06: T. Booth/Pierce Co. Planning memo to Longbranch shellfish, re: site visit and further clarifications.

* 2006: C. McKindsey, et al./DFO-Canada, Resch. Doc. 2006-011: Effects of shellfish aquaculture on fish habitat.

* 1/22/07: P. Dorn/Dorn Salmon Enhancement Services, Longbranch Shellfish project site, Habitat Assessment Report.

* 3/14/07: Dethier, Leitman and Matthews, report reviewing concerns for impacts of geoduck aquaculture.

* 1/10/08: C. Earle/Jones and Stokes, memo to C. Veenestra/ACOE, memo summarizing comments/responses to Service assessments of NWP-48.

* 9/4/08: K. Larrabee/Pierce Co. Planning memo to GordonDerr LLP/Plauche outlining three issues before DS determination.

* 10/22/08: S. Plauche/GordonDerr memo+attachments to K. Larrabee/Pierce co. Planning response to three issues.

* 12/9/08: K. Larrabee/Pierce Co. Planning memo to Longbranch Shellfish outlining differences between “Foss site” and Longbranch site.

* 2/8/08: J. Fisher, et al./Environ, Tech. Memorandum, “Analysis of…geoduck clam aquaculture”.

* Undated: C. Puddicombe letter to WDNR commenting on Environ geoduck farm technical memorandum.

* 3/09: USFWS Biological Opinion report for NP-48 to L. Evans/ACOE-Portland

* 5/1/09: J. Gibbons/Seattle Shellfish LLC memo to C. Kleeberg/Pierce Co. Planning reviewing issues.

* 5/4/09: D. Risvold/Pierce Co. Planning memo to V. Barry, outlining two remaining principle issues.

* 6/15/09: D. Risvold/Pierce Co. Planning memo to B. Shoos, outlining concerns and survey needs following NMFS/USFWS comments.

* 1/14/10: Plauche & Stock LLP memo to T. booth/Pierce Co. Planning resolving outstanding issues: withdrawal of manila clam culture, distancing from sand lance habitat, worm tubes not herring habitat.

* 2/3/10: D. Risvold- Pierce Co. Planning/D. Penttila-WDFW e-mail exchange re: worm tubes.

* 2/5/10: D. Risvold/Pierce co. Planning memo to B. Shoos, reporting apparent resolution of outstanding issues.

* 2/5/10: D. Risvold/Pierce Co. Planning memo to B. Shoos, reviewing continued issues.

* 2/5/10: T. Booth/Pierce Co. Planning memo to Longbranch Shellfish outlining SEPA findings of fact.
* 5/13/10: Longbranch Shellfish project, SEPA Environmental Checklist

* 5/26/10: Pierce Co. Planning determination of Non-Significance for Longbranch Shellfish project.

* 7/1/10: T. Booth/Pierce Co. Planning, Longbranch shellfish project Staff Report.

Additional possible exhibits routed to Hendricks on about 11/30/10:

* D. Penttila, 1978. Studies of the surf smelt (*Hypomesus pretiosus*) in Puget Sound. WDF Tech. Report #42, 47 p.

* D. Penttila, 11/23/92. WDF Forage Fish Unit field report: "S. Carr Inlet-Drayton Pass". First-ever WDF spawning habitat survey through Longbranch Shellfish project area, finding surf smelt spawning beach in vicinity.

* D. Penttila, 1/5/96: WDFW Forage Fish Unit field report: "S. Case Inlet-W. Nisqually Reach". Sand lance spawning beach found on Longbranch Shellfish project site.

* D. Penttila, 1/19/07: WDFW Puget Sound Action Team Forage Fish Project field report: "Drayton Passage, Pierce Co." Surf smelt spawn again found in Longbranch Shellfish project area.

* D. Penttila, 1995a. The WDFW's Puget Sound intertidal baitfish spawning beach survey project. In the Proceedings of the Puget Sound Research-95 Conference, PSWQA, Olympia, WA, Vol. 1, p. 235-241. A review of current WDFW surf smelt/sand lance spawning beach survey protocols.

* D. Penttila, 1995b. Investigations of the spawning habitat of the Pacific sand lance (*Ammodytes hexapterus*) in Puget Sound. In the Proceedings of the Puget Sound Research-95 Conference, PSWQA, Olympia, WA, vol. 2, p. 855-859.

* D. Penttila, 1995c. "Known spawning beaches of the surf smelt (*Hypomesus*) and sand lance (*Ammodytes*) in southern Puget Sound (Pierce, Thurston and Mason counties), as of March 1995." unpub. WDFW report, 50+ pages. I sent chart excerpts of Longbranch Shellfish project area.

* D. Penttila, 2000. "Grain-size analyses of spawning substrates of the surf smelt (*Hypomesus*) and Pacific sand lance (*Ammodytes)* on Puget Sound spawning beaches", WDFW unpub. informational handout. Pooled data from beaches through Puget Sound.

* Moulton L. and D. Penttila, 2001, rev. 2006. Field manual for sampling forage fish spawn in intertidal shore regions. San Juan County Assessment Project, 23 p. Current WDFW survey protocols.

* D. Penttila, 2007. Marine forage fishes in Puget Sound. Puget Sound Nearshore Partnership Tech. Rep. 2007-03, ACOE Seattle District, 22 p.

ISSUES AND CONCLUSIONS:

Forage Fish Habitat issues:

Herring:

The farm site is several miles away from the closest documented herring spawning areas in Mayo Cove, Wollochet Bay and Squaxin Passage., thus direct impacts to spawning habitat cannot be an issue. Herring hatch at about 7 mm in length, and would presumably be rare at the geoduck farm site. Young- of- the-year herring will not be common around the project site, given its distance from the hatching areas. By the fall of their first year, the local herring will be large enough that they will dwell in deep waters offshore of the shoreline, so probably wouldn't interact with the farm structures at all.

Surf smelt:

Documented surf smelt spawning habitat occurs just north of the farm site. Spawning would occur during the fall-winter months.

One concern would be impacts of the use of ATVs if any on the spawning habitat. I don't know if the farm plans on using ATVs to access its culture plots, but such should be banned, and the farm should be accessed by-boat only, unless it can be demonstrated that ATV use does not degrade those upper intertidal beaches.

Another concern I have regarding surf smelt is the potential for mass mortalities of fish via gilling in anti-predator webbing. On one occasion (only) back in the 1980s, an incident of surf smelt being gilled in anti-predator webbing on a clam culture plot in southern Puget Sound was brought to my attention. The ripening fish tend to rove to and fro along shorelines just offshore of their spawning sites, in about the same zone as might be occupied by shellfish culture plots. Broad-scale use of large area of anti-predator webbing might result in fish gilling in dislodged sheets hanging vertically in the water column.

Sand lance:

Documented sand lance spawning habitat is positioned directly inshore of the farm site. The spawning season would be November-February. If the farm plan is to be trusted, there will supposedly be several vertical feet and 150'+ lateral feet separating the sand lance habitat and the farm plot. I cannot argue that such distances will not be sufficient to buffer the spawning habitat from the farm. I question how closely the farm operation will stick to the written plan and who will enforce the plan's details.

The behavior of ripe or spawned-out sand lances in the vicinity of their spawning beaches is not known in any detail. The fish may rove to and fro along the spawning habitat like ripe surf smelt, before turning inshore to begin spawning. They may burrow into the sandy substrates of the intertidal zone in the general areas of their spawning beaches during the spawning season and at other times of year as well. No observations or scientific analysis has been made, to my knowledge, as to how near-shore-burrowing sand lances react to the presence of geoduck farms.

The fish might be deterred from normal burrowing behavior near-shore by geoduck tube arrays covered with broad befouled sheets of anti-predator webbing. Their shape and behavior would probably prevent them from being gilled at the mesh sizes used.

They might also be deterred from burrowing if the sediments between the culture tubes were modified by organic material to the point that they become anoxic within a few centimeters of the surface of the substrate. Recent lab experiments have shown that sand lance will bury in a wide variety of sediment grain-sizes, but may avoid using stinky muds.

An EIS would be served by field-documentation of sand lance behaviors in an existing geoduck farm versus adjacent un-farmed plots. In all of south Puget Sound's farmed areas, there should be a number of plots where the farms coincide with previously-documented sand lance (and surf smelt) spawning beaches.

Macro-algae concerns:

The proposed Longbranch Shellfish geoduck aquaculture project site will change the character of the existing macro algal community within the culture plot. The site reportedly does not support significant algal cover in its present condition. This should be confirmed by current aerial photos or site visits in the spring of 2011.

In many parts of Puget Sound, a lower intertidal tidal flat would be expected to support at least a minimal algal community, depending on the nature of the sediment sizes available on the surface. The project site is reported to be fine-grained enough that little occurs in the way of macro-algae. Any solid objects within the project site would presumably support a small community of macro-algae, probably species of *Fucus, Ulva, Gracilariopsis, Porphyra, Chondracanthus,* the exotic *Sargassum,* and a few other genera. These forms would also be expected to colonize the solid surfaces of the tubes and webbing used in the farm operation during the initial year or two of grow-out before those structures are removed. The community would be periodically destroyed if the farm operation included periodic cleaning of the anti-predator netting.

One concern I would have regarding the development of a thick befouling algal community on the farm tubes and netting might be that the growth could become thick enough that their stability might be compromised in the face of high wave action periods, and the structures uprooted from the project area and caste up on the local beaches as wildlife-entangling garbage or floating hazards to navigation, both of which I have observed in past years in other aquaculture areas in southern Puget Sound.

The Drayton Passage area within a mile or two of the project site has been documented in the past to be an area of herring concentrations in the months prior to spawning. Another concern I would have with the establishment of a marine algal community where one does not presently exist is that it could conceivably become an inadvertent target for spawning herring, at a site which does not presently support herring spawning activity. If the farm structures were permanent, this would not necessarily be a bad thing, but it could represent a significant potential loss of herring spawn if the structures were removed or managed in other ways that would remove or otherwise harm incubating herring spawn. Reportedly, Taylor Shellfish has a best-management practice that allows observed herring spawn on aquaculture structures to incubate and hatch without disturbance if it is recognized on-site. However, there is no indication in the documents as to the degree to which this policy is followed or enforced in the grounds.

Eelgrass comments:

The site is apparently within that zone of southernmost Puget Sound where little if any native eelgrass (*Zostera marina*) naturally occurs. I view it as unlikely that even if the farm plot is established, it will result in the establishment of native eelgrass beds in its midst, as is reported in some aquaculture areas. It is possible that during the course of farm operations over the years, the exotic species, *Z. japonica*, might come to be present in the project area. It is reported to be spreading southward into parts of Puget Sound where it does not yet occur. It would likely occupy a tidal elevation shoreward of +0', perhaps still within the zone of the proposed farm. In terms of conservation and management, this species is not the ecological equivalent of the native eelgrass. There are in fact recent suggestions, arising largely from the aquaculture industry, that it should be considered an invasive exotic species in need of some means of chemical control. Such controls should not be contemplated in the midst of sensitive habitats such as the project site in question.

In the available report collection, the USFWS biological opinion report alludes to an "Environmental Code of Practice' adopted by the Pacific Coast Shellfish Growers Association (PCSGA), largely taken as appropriate by USFWS in adopting standard for the protection of eelgrass and herring spawning habitat. Dated to 2002, I question, as does USFWS in its report, the degree to which these "guidelines' are followed by the industry. Around that year of publication, I was still personally witnessing the routine dredging of ground-cultured oysters in and around herring-spawn-bearing eelgrass beds in the Oysterville-Stackpole Harbor area of Willapa Bay while conducting WDFW herring spawn surveys. Similarly, the Environ technical memorandum references a Taylor Shellfish "Code of Practice" that alleges protection of eelgrass beds, with no evidence of the degree to which it is adhered-to by farm managers. The effectiveness of the industry's eelgrass/herring spawning habitat protection guidelines should be carefully analyzed in a EIS.

Plankton depletion issues:

This topic is constrained by a lack of basic data sufficient to call for additional research for an EIS prior to any further expansion of geoduck farms. Following are some point of contention as I see them:

While the number of farmed geoducks per acre of farm is an unnaturally high density for the intertidal, the adverse impacts are unknown, at least in the available literature I reviewed. Without such data, the impact of the extra "mouths to feed' cannot truly be assessed.

The issue of ingestion of forage fish larvae by geoducks is also without sufficient data, in my view. Surf smelt larvae hatch at about 6 mm in length, and sand lance at about 5mm in length. Encumbered by yolk sacs for a week or two after hatching they are thought to have little swimming power during that period. Hypothetically, they could be ingested by geoducks at that time, if it were known that they tended to reside close to the bottom, within the range of the suction of incurrent geoduck siphons.

The available reports suggest that oysters may have greater filtration rates than geoducks, and yet to my knowledge, the impacts of the vastly larger oyster aquaculture industry on plankton resources and larval ingestion have never been questioned. Perhaps it should be now.

I could conceive of research where the reaction of forage fish larvae exposed to geoduck in-current siphon velocities could be studied. It would be relatively easy to collect forage fish eggs of all species for culture to hatching under lab conditions, after which time they could be subjected to feeding geoduck in lab tanks, and their reactions and abilities to escape could be recorded.

This would also be an opportunity to study another significant unanswered question: Do geoducks have the capability of rejecting/"back-flushing" overly-large zooplankton organisms during the feeding process, and can these organisms survive such a mechanism intact and un-harmed?

Comment on the Dorn habitat assessment report for the farm site:

The Dorn report refers to the inspection of the site by an otherwise unidentified "fish biologist", and certain statements alleging no likely impacts of the project to forage fishes. I checked the 2002-2010 attendance list of those who participated in my annual surf smelt/sand lance spawning habitat survey protocol "certification" course, intended to give consultants knowledge of forage fish spawning habitats and survey methods by which spawn can be sampled. WDFW insists that shoreline development proponents drawn from this list for technical expertise if an HPA application includes concerns over forage fish spawning habitat impacts. Paul Dorn was not on the list. He may have attended one of my forage fish community workshops held in Kitsap County in recent years, but these workshops do not equate with the level of training presented in the certification classes. A genuine assessment of the farm site for forage fish issues would have been conducted in December, when there was the possibility of both surf smelt and sand lance eggs to be present on or near the site, not May.

Issue of discrepancy between siting of wild geoduck and farmed-geoduck aquaculture operations:

The disparate policies of siting subtidal, wild-geoduck harvest leases on bottomlands no shallower than -18 feet in tidal elevation, for the benefit of juvenile salmonids (Simenstad, 1999), while allowing conceivably even more impacting geoduck farm operations to occur within this very important nearshore migratory habitat zone needs to be explained and justified, if possible, through an EIS.

Issues with significant inaccuracies in the geoduck farm's SEPA document:

While the Dorn seine-sampling fish species composition was reported in the Habitat Assessment survey of 2007, The 2010 SEPA document did NOT report the presence of Herring and several species of Salmon, as instructed to "circle" within the "Animals" section list. The SEPA document also does not indicate that the site is a migratory route. As illustrated by the presence of numbers of juvenile salmonids in the beach seine catches at the site, and its typical shoreline location, the site clearly is a migratory corridor for them, as Puget Sound shorelines are generally known to be. These are serious oversights in the SEPA document.

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